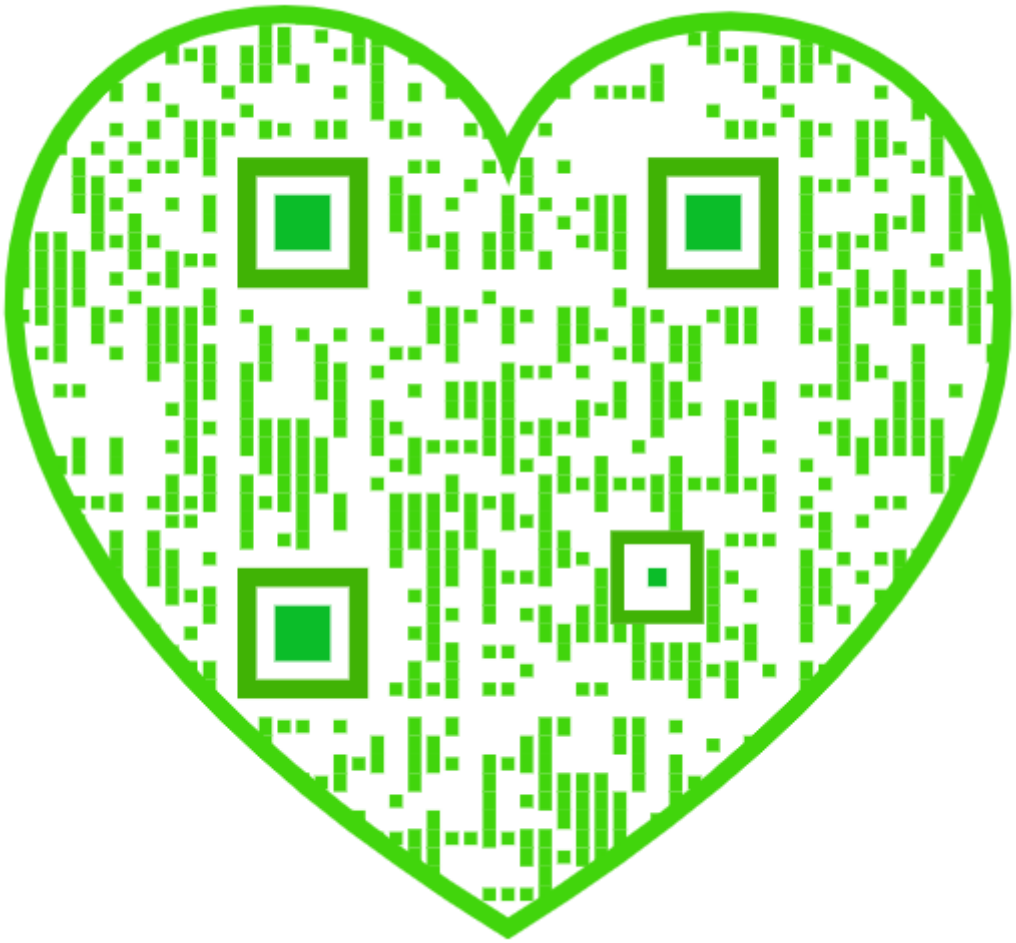


PRINCIPLES OF TEACHING IN SECONDARY EDUCATION

BY

HERBERT H. FOSTER, PH.D.

PROFESSOR OF EDUCATION IN THE UNIVERSITY OF VERMONT

CHARLES SCRIBNER'S SONS

NEW YORK CHICAGO BOSTON

LB1607
.F6
IMPERFECT COPY.

COPYRIGHT, 1921, BY
CHARLES SCRIBNER'S SONS

21-2529

FEB -7 1921

Δ

CI.A605692

TO

MY MOTHER

PREFACE

"The bane of high school science teaching is the notion that it must be taught differently from other subjects." These words, spoken to the author by a widely known science teacher, are in harmony with the statements of many prominent and successful teachers in other branches of high school study. Some years ago, having occasion to make a comparative study of all the available books on the teaching of secondary school subjects, the author was impressed by the striking parallel between the best of the books whenever method of instruction was treated. The chief differences were matters of omission, and the omissions in books in the same field were far from being the same. The only possible inference was that certain general principles of method are valid in all of the studies of the high school curriculum, and that the task of each teacher is not to construct his educational method regardless of these principles, but to adapt their application to his particular field.

The present text is an attempt to assist the prospective or untrained teacher in a study of the principles upon which method in secondary instruction must be based. The book is a protest against formalism and mechanism, on the one hand, and unsystematic procedure on the other. The point of view is functional, in that in each step there is a procedure from discovery of aim to adaptation of process to aim. The author is also governed by the conviction that a well-planned lesson is more than a mere series of topics for study, but as a whole possesses an organic unity. While at least the greater part of the content of the book is applicable to all stages of

instruction, it is intended especially for the work of the secondary school, including the junior high school.

The book is designed to assist in the training of teachers. Hence it must constantly be supplemented with intelligent, sympathetic observation of actual secondary school instruction. The reader should throughout strive to trace the application of the principles to the field in which he hopes to teach. To the experienced teacher this practical application and significance will be more immediately apparent. In any case, this study of the principles of method in terms of the schoolroom and of one's special subject will be the *sine qua non* for the gaining of much practical benefit from the text.

The author takes the liberty to suggest to instructors and students that a careful reading of the analysis of each chapter or section, as given in the table of contents, precede the study of the text. By this method one will doubtless gain a better preliminary conception of the problems raised and of their treatment. To the reader who is unfamiliar with the principles of education and of educational psychology, it is suggested that the supplementary readings be read before the chapters of the text to which they are appended. It is the aim of the author to mention only a few representative readings rather than to give an extended bibliography.

A considerable part of the material of the text, and especially the attempt at organization of principles for the teacher's use, is the product of the author's experience and observation. Ten years of work in secondary education, in administration and teaching, and in the supervision of practice teaching has been the laboratory in which the practical test of these principles has been made. The principles are not new, but are being applied to-day, though often unconsciously, by the more progressive and successful teachers of our secondary schools.

The book, excepting the last four chapters, was written several years ago, and has in manuscript form been used as

a text-book in several institutions. A number of changes have resulted. In the meantime have appeared the excellent texts by Professor Parker and Professor Colvin, but the author feels that the difference in view point of the present text justifies offering it to the educational public.

Acknowledgment must be made of obligation to a number of educational writers, notably Professors Thorndike, Dewey, and De Garmo. To a number of friends who have read the manuscript, the author is indebted for helpful suggestions. Students who have used the book as a text have been of great assistance in rendering it usable as a classroom text. Professor Alexander Inglis, of Harvard University, has contributed a wealth of extremely helpful criticism and suggestion. Finally, the author renders grateful acknowledgment to his wife, whose professional training and experience as well as personal encouragement and assistance have done much to give the book any merit it may possess.

CONTENTS

CHAPTER I

INTRODUCTION

PAGE

1. MEANING OF METHOD 1

Method is the way of doing anything, including teaching. The "born" teacher and the trained teacher.

2. BASIS OF METHOD IN SECONDARY INSTRUCTION . . . 5

The validity of the principles of educational psychology constitutes the basis for the validity of the principles of teaching. The psychology of adolescence is the basis for secondary method. General *vs.* special method. The native interests of the student and their functioning in learning.

3. SUMMARY 9

CHAPTER II

SOME FUNDAMENTAL PRINCIPLES IN LEARNING

1. THE CHILD'S EQUIPMENT 10

Teaching must treat the child as a bundle of native and acquired tendencies to action.

2. INTEREST AND TEACHING 11

The teacher must induce interest in the subject matter, even though the interest be indirect. He must direct the student's interest into the most fruitful paths.

3. ATTENTION AND TEACHING 14

Attention is an essential in learning. Passive attention is the most favorable for learning, but is not always attainable. Active attention should lead to secondary passive attention.

4. ASSOCIATIVE LEARNING 17

Rules for securing simple associations. Association after dissociation involves analysis followed by synthesis. Rules for securing association after dissociation.

PAGE

5. The Transfer of Acquired Efficiency 21

The doctrine of the transfer of acquired power is a prominent factor in curriculum and instruction. What truth it possesses lies in the identity of the elements in the thing learned and in that to be learned. The principle involved is association after dissociation. In order to secure transfer of training, a variety of instances should be made basal in deriving a concept, the meaning as well as the form of the thing learned should be emphasized, and a variety of applications should be employed.

6. Summary 25

CHAPTER III

AIMS IN INSTRUCTION

1. Educational Aims 28

The seemingly disparate formulations of the aim of education are fundamentally agreed upon five elements. These are in terms of knowledge, sympathy, thought-power, ability to express and act, and permanence of character and attainment.

2. Essentials and Factors of Instruction 30

Relation of instruction to education. Teaching must produce knowledge, thought-power, sentimental development, efficiency, and permanency. These suggest the six fundamental factors of method in instruction: acquisition, reflection, expression-application, appreciation, drill, and test.

3. Importance and Character of the Lesson Aim . 35

It facilitates definiteness and flexibility of procedure. Teacher's aim and student's aim are to a considerable degree coincident, especially in secondary education. Community of aim facilitates co-operation. The aim may be expressed in terms of subject matter, as well as in terms of the various factors of method. The lesson unit.

4. The Five Modes of Instruction 39

The Recitation, Problematic, Appreciation, Expression-Application, and Laboratory Modes. Relation between teaching modes and lesson types. The "formal steps" of the lesson; their suggestive value and their danger.

5. Summary 41

CHAPTER IV

THE CLASS EXERCISE

1. Meaning 43

The term is used for all forms of classroom activity, and means much more than mere recitation. The class exercise is the occasion for the employment of all the forms of instruction.

PAGE

2. PERSONALITY IN THE CLASS EXERCISE 45

The true method provides opportunity for the best development of personality of both teacher and pupil. Whatever negates either is bad method.

3. THE ATMOSPHERE OF THE CLASS EXERCISE 47

Cheerfulness and enthusiasm are positive factors in instruction.

4. THE CLASSROOM ACTIVITY 48

Activity is fundamental in learning. Blackboard work. The mood of expectancy. Distribution of activity between teacher and class; between members of the class. The teacher's preparation as a means for increasing the efficiency of class work. The "tempo" of the classroom.

5. SUMMARY 53

CHAPTER V

THE QUESTION

1. ITS FUNCTION 55

In teaching, the question serves not merely to obtain information but also to bring the student to consciousness of a need and to stimulate thought.

2. KINDS OF QUESTIONS 56

Memory question. Analytic questions. Development questions. Comparison-contrast questions. Judgment questions.

3. THE ESSENTIALS OF GOOD QUESTIONING 59

The question must be thought-provoking, clear, brief, and adapted to the student.

4. THE MANNER OF QUESTIONING 63

1. Questions should be addressed to the class, although answered by one student. 2. Questions should be distributed among the pupils, taking account of the students' ability and special needs. 3. The teacher should manifest an interest in the question.

5. THE QUESTION AS AN INDEX OF EFFICIENCY IN TEACHING 67

The number of questions, and the distribution of activity between teacher and class.

6. THE ANSWER 68

The answer must be adequate and matured. The topical recitation. The form of expression in the answer.

7. THE PUPIL'S QUESTION 71

Its importance and treatment.

8. SUMMARY 72

CHAPTER VI

THE RECITATION MODE

PAGE

1. MEANING OF RECITATION 74

The recitation as mechanical reciting. The opposite extreme. True function of recitation.

2. THE RECITATION AS TESTING 75

Its aim is to insure progress: by determining faithfulness, adequacy of preparation and instruction, and appropriateness of material, and by providing opportunity for expression and correction. When is a lesson adequately prepared? The enforcing of preparation. The oral quiz, and its functions. The examination, its aim and requirements.

3. THE RECITATION AS DRILL 83

Drill is to render processes or memories stereotyped and automatic. Applicability of drill. Its dangers: excess and insufficiency. Relation of attention to drill. Drill as habit-forming: initiation and fixation. Drill as memory-forming: learning, retention, recall, and recognition. Memory content must be deeply impressed, and widely and strongly associated. Repetition in drill: its degree and distribution. Drill must be intelligent, applied, and sufficient. The meaning and criticism of cramming.

4. PROPÆDEUTIC FUNCTION OF THE RECITATION . . . 94

Learning as apperception. The recitation as a preparation step. The recitation as a sole mode in instruction.

5. SUMMARY 98

CHAPTER VII

LESSON DEVELOPMENT

1. LEARNING AND FEELING 100

The curriculum is a system of situations for the student. His meeting of the situation; knowledge of it, its appeal to him, his response and expression. The response is as intellectual or as sentimental, as learning or as feeling. Learning as informational or as problematic.

2. DEVELOPMENT IN TEACHING 102

Nature of development. Student activity is fundamental in development. Difficulty in its use.

PAGE

3. General Principles of Development Instruction . 106

From known to unknown. Analogy: its character and essentials. From simple to complex; limitations of the principle. From concrete to abstract; must end in further concrete. Illustration, as a form of the concrete. Its place and use in instruction. Essentials of good illustration: familiarity, accuracy, simplicity, significance. Student's contribution in development. Over-instruction.

4. Typical Forms of Development 118

Socratic, heuristic, lecture. Applicability of each.

5. The Place of Development in the Class Exercise 123

Following the recitation. Relation to lesson assignment.

6. Summary 126

CHAPTER VIII

THE PROBLEMATIC MODE

1. Character and Function 129

A problem is any situation stimulating to knowledge or thought. Informational and thought problems. Thought problems as inductive and deductive.

2. Sources of Information 132

Telling, reading, and discovery. Advantages and dangers of telling. Advantages and dangers in use of text-book. Value of discovery as source of information. Requirements of good telling, of good text-book use, and of student's observation. The information problem as simple association.

3. Composition of an Act of Thought 139

Recognition and formulation of problem, hypothetical solution, reasoning out the implications, and verification. The thought problem is a form of association after dissociation. Induction *vs.* deduction in teaching.

4. Procedure in the Thought Type of the Problematic Mode 142

1. Recognition and formulation of the problem. Problem must be definitely understood by both teacher and pupil. Inductive and deductive problems. Problems must be real, arising out of the student's experience and needs. Meaning of "reality" of problem. The project method. 2. Tentative solution of the problem. Its form. Hypothesis must be a definite one for the student and a real solution to the problem. 3. Reasoning out the implications of the problem. The student must be the real thinker, rather than adopt another's thought. The reasoning must be sound. 4. Verification of the hypothesis. The concrete of the original problem and that of the verification. Relation of verification to application. Degree of rigor in veri-

fication, and attitude of student toward proof. Verification should be definitely formulated, since it encourages clearer thinking and offers opportunity for conviction. Explanation: its character, function, and essentials. Meaning of demonstration. The teacher's place in the problematic mode.

PAGE

5. APPLICATION OF THE PROBLEMATIC MODE IN TEACHING . 163

Its application and forms in various studies. The transfer of training in the problematic mode. The place of problematic procedure in the class exercise.

6. SUMMARY 170

CHAPTER IX

THE APPRECIATION MODE

1. CHARACTER AND FUNCTION 173

Appreciation as the sentimental response to a situation. Aim of appreciation instruction, to lead to the most adequate and helpful response.

2. TYPES AND FORMS OF APPRECIATION 176

Intellectual, æsthetic, and ethical; based upon the three types of sentiment. The place of the different types in the various studies of the curriculum.

3. PROCEDURE IN THE APPRECIATION MODE 177

Based on creating the right type of situation. 1. The teacher must catch the spirit of the situation. 2. The situation must be made as real and vivid as possible, by suggestive imagery, both sensory and idealized. 3. The student must understand the medium of expression of the material studied. The securing of this understanding; its method and limitations. 4. An analysis of the content is necessary, yet if overdone will prevent appreciation. 5. The appreciation situation must be such as to arouse the activity of the student. He must feel it as one which has a personal significance for him. Pettiness and artificiality in appreciation instruction. 6. Atmosphere of the classroom in appreciation instruction; its importance and control. The tempo of appreciation.

4. SUMMARY 186

CHAPTER X

THE EXPRESSION-APPLICATION MODE

1. CHARACTER AND FUNCTION 188

Expression and application are the student's extension of the learned and felt to further persons and objects. Value of the expression-application mode: it tests the instruction, renders impressions definite and permanent, and provides skill in the use of knowledge.

PAGE

2. Forms of Expression and Application 190

Opportunity occurs in almost all instruction. Expression in English composition. Application in laboratory, translation, and exercises.

3. Home Study as Application 194

Not an independent preparation for recitation. Essentially an extension and amplification of the classroom application.

4. Essentials of Expression and Application . . . 196

Determined by function. Expression shall be: 1, adequate; 2, general. Application shall: 3, immediately follow the development; 4, be typical; 5, intelligent; 6, general.

5. The Lesson Assignment 201

Relation to classroom application. Should come at close of class hour. Definiteness of assignment. Stimulating to thought.

6. Summary 205

CHAPTER XI

THE LABORATORY MODE

1. Character and Function 207

Relation to home study, to the development mode, to the application mode. Fivefold function: acquisition of knowledge or sentimental experience, application of methods of study, training in observation and induction, technic and manual skill, verification.

2. Types of Laboratory Work 211

Experimental, observational, appreciation, and application. Meaning of experiment, and its use in the secondary school. School laboratory and field excursion. Description of results in observation; by language, by drawings. Inference from the observations. The appreciation laboratory exercise. The application laboratory.

3. Essentials of Laboratory Instruction 216

1. Problem must be real; originating in the classroom work. Definiteness of problem; in aim and in instructions. 2. Threefold function of the teacher in the laboratory: to provoke thought, prevent waste of time and material, direct to sources. 3. Use made of results in the laboratory. Results should be definitely thought through, adequately described, correlated with the classroom work.

4. Summary 220

CHAPTER XII

STUDY AS SELF-TEACHING

PAGE

1. SIGNIFICANCE OF STUDY 222

It develops initiative and self-control. The wisdom of home study.

2. TEACHING TO STUDY 223

Study is self-teaching, and follows the methods of class teaching. Securing the problem attitude. Getting one's bearings. Use of sources of information. Habit-forming and memory-forming in study. Training pupils to recognize problems, to formulate hypotheses, to reason out the implications, and to verify. Appreciation study through understanding of medium of expression, vividness of imagery, and judgment forming. Home study as application. Physical and mental conditions for effective study.

3. SUPERVISED STUDY 241

Meaning and need of supervision. Forms of its administration.

4. SUMMARY 244

CHAPTER XIII

LESSON ORGANIZATION

1. SIGNIFICANCE OF ORGANIZATION 247

The modes are not methods but the components of methods. Lesson organization as a synthesis of modes.

2. THE LESSON PLAN 248

The planning of the lesson, involving determining of aim, selection of content, organization of thought, formulation of pivotal questions, and provision for expression-application. Importance of the assignment. The recitation mode as the completion of the cycle. Use of laboratory mode.

3. SUMMARIES IN THE LESSON 254

Character and function of the summary. It should be developed, rather than dictated.

4. REVIEW AND THE REVIEW LESSON 255

Character of review, involving essentials only, for purpose of organization. Its frequency and forms.

5. SUMMARY 257

CHAPTER XIV

STANDARDS AND MEASUREMENTS IN INSTRUCTION

PAGE

1. EFFICIENCY IN TEACHING 259

Importance of measurement of results; for the determination of students' progress, the comparison of the work of various classes and schools, the investigation of methods of instruction, and the discovery of individual differences and needs.

2. ESSENTIALS OF STANDARDIZATION 263

Objectivity, definiteness, absoluteness, inclusiveness, practicability. Exact measurement is possible only when there is an available standard, when the thing measured is definitely known, and when the zero degree of the quality investigated for can be determined. The aims of instruction are basal in the evaluation of educational products.

3. TYPICAL STANDARDS AND FORMS OF MEASUREMENT . . 271

Absolute *vs.* comparative measurements. Various scales and tests for elementary and secondary school subjects. The principle of the normal distribution of abilities, and its use as the basis for grading of students' work. The advantages and limitations of "scientific grading."

4. THE PRACTICAL VALUE OF STANDARDIZATION AND MEASUREMENT IN SECONDARY INSTRUCTION 292

Use of the standard tests in secondary education. The improvising of further tests. Suggestions for testing: isolation of factor tested, adaptation of tests, importance of uniformity and clarity in testing. The grading of classes other than normal; by seeking to distribute the grades of several successive classes viewed as one, and taking account of the grades of other teachers. Significance of grade distribution for classes not normal.

5. SUMMARY 306

CHAPTER XV

INDIVIDUAL AND SOCIAL ELEMENTS IN SECONDARY INSTRUCTION

1. INDIVIDUAL INSTRUCTION 309

Its meaning. It is based on individual differences. Differences of environment and their utilization. Differences due to heredity: of thought, of disposition, of action. Both idea-thinkers and thing-thinkers must be recognized in instruction. Treatment of temperamental differences. Following-up instruction; the classroom application, the laboratory, the study hour, the personal conference.

PAGE

2. Social Instruction 319

Its meaning. Its aims: social intelligence, social disposition, social efficiency, social habit. Social intelligence includes knowledge of the curriculum, of society, of the self. Social disposition is determined somewhat by content, but more by the spirit and form of instruction. Social efficiency requires that opportunity for social action be provided in instruction. Social habit, secured by motivated repetition. The agencies for social instruction: the class exercise, the laboratory, the study hour. Student co-operation and teacher leadership in the class exercise. Students' part in socialized instruction: co-operation, direction, participation. The laboratory as an opportunity for social instruction. The study hour.

3. The Relation between Individual and Social Instruction 336

Not antagonistic, but as phases of a unity. Socialization of the individual, and its meaning for instruction. Individual and social instruction as differentiation and integration.

4. Summary 338

Appendix 341

Lesson plans; in physical geography, algebra, United States History, English, Spanish, and Home Economics.

Index 361

PRINCIPLES OF TEACHING

CHAPTER I

INTRODUCTION

1. Meaning of Method

Methods as Ways of Doing Things.—The modern business world, in its quest for efficiency, is devoting more and more attention to method. The test of business methods is being applied to educational administration, and the question, "How are you teaching?" must be faced by the instructor as squarely and as frankly as by the administrator. In its literal meaning the term "method" refers simply to a way or mode of doing anything. Our ways of holding the book in reading, of describing an event which we have witnessed, or of persuading a customer to purchase our wares—all these are methods. Thus we have methods of walking, of speaking, of studying, and of instructing. One can no more teach without method than he can walk or speak without muscular activity. In Professor Dewey's words: "The teacher needs to recognize that method covers not only what he intentionally devises and employs for the purpose of mental training, but also what he does without any conscious reference to it—anything in the atmosphere and conduct of the school which reacts in any way upon the curiosity, the responsiveness, and orderly activity of children."[1] The skilled educator teaching a "demonstration lesson" in the teachers' college and the schoolgirl explaining a problem in division to her younger sister are both employing method in their teaching, though differing widely in efficiency as educators.

[1] Dewey, "How We Think," p. 42.

Consciousness in Method.—What causes this difference in efficiency? Wherein is the method of one superior to that of the other? As a means of enabling the younger child to work the problem, the girl's method has a measure of efficiency, but for real educative service its value may be negligible or even negative. She has but little understanding of the ultimate aim of the work and still less of the means. The skilled educator, on the other hand, knows quite definitely just what he is seeking to accomplish, and is employing wisely selected and adapted methods for its accomplishment. Therein lies his greater efficiency as an instructor.

A fundamental element in his skill is knowledge of end and means. Having his aim ever in mind, he is able at each stage in the process to employ those modes of teaching which a knowledge of the child mind and the results of his own and others' experience indicate as the most serviceable for his purpose. The schoolgirl relies almost wholly upon imitation, largely unconscious; the skilled educator's method is the product of conscious and intelligent selection throughout.

Skill in Method.—But the teacher's skill is more than knowledge. In his long years of training he has carefully studied the principles of teaching, has come to understand them, and has with experiment and observation put them into conscious application so many times that their application is now in a measure a matter of habit. He has made these principles of method his own, so that their application has become in a large measure unconscious and automatic. Some one has said that "sound practice is sound theory unconscious of itself." Otherwise worded, it means simply this. Good teaching is the constant interplay of theory and practice. The skilful teacher never loses sight of his aims, both principal and subordinate. On the other hand, the constant purposive application of educational principles in the realization of those aims has resulted in an ever-increasing skill in such application. The processes of ever greater complexity have become natural and automatic, until he is able

to realize his aims with a high degree of efficiency because the subordinate processes have become largely automatic. As the oarsman in the college crew must consciously and carefully follow the instructions of the coach until his rowing is accurate without his thinking of instructions, so the teacher can attain corresponding skill in teaching only through the training resulting from conscious, careful, persistent application of educational principles. His attention, thus released from technic, is free for the larger consideration of his task.

It is just at this point, the rendering of educational processes unconscious and automatic, that the crucial stage of professional training is encountered. Whether we become progressive teachers or fall into a rut in our profession depends almost wholly upon our attitude toward our method. It, like habit, makes a good servant but a bad master, and the teacher who can use good method in the intelligent accomplishment of his purposes, who can automatically apply educational principles in the realization of ever-conscious aims, will experience therein not the depression of drudgery but the spiritual exaltation of work. The danger is that of losing consciousness of purpose and hence permitting habit alone to control procedure.

Types of Teachers.—Much has been said of the "born" teacher. Certain it is that great differences of native aptitude for teaching exist. It is the author's belief, however, that much misconception in the matter exists. In our observation, most if not all so-called "born" teachers owe their reputation to two things. In the first place, they are by nature unusually sympathetic and observing, and in their instruction are more quick to detect failure and to make required adjustments before wrong procedure has more than begun. Secondly, their sympathy and enthusiasm induce a highly responsive mood and activity of mind on the part of students, which are well known to be most favorable conditions for learning, whether with or without a teacher. Possibly, too, they remember well the way in which they learned

the material, with its difficulties and successes. If we add to these elements the resultant one of popularity, the author believes that we have the key to the success, both real and reputed, of the "born" teacher, or "genius."

A more real character in pedagogic caste is what Professor De Garmo calls the artisan teacher. Too many teachers, because of narrowness either of training or of perspective, lose sight of the broader principles and aims of education, and reduce teaching to an unthinking, unelastic mechanism. They are sticklers for methodology, but fail to catch the vision of true education. To the "artist" teacher, on the other hand, method is but the means to an end; the best way of realizing the ultimate aims of instruction.

For the first class of teachers, the geniuses, or, as Professor Rein calls them, "teachers by the grace of God," the teaching art is largely inborn, not acquired by study. But their number is indeed small, if indeed there be such. Unhappy is the teacher (and still unhappier his pupils) who, although not even an artisan, mistakes himself for a genius and, trusting to inspiration, scorns anything which savors of method. On the other hand, let us not sink to the plane of the artisan, and think of a study of teaching-method as an attempt to take over and incorporate certain stereotyped formulas of procedure, warranted to work whenever certain specified situations confront us. The truth is that no artist teacher ever employs exactly the same method as his colleague, nor follows unchanged his own former practice. The study of the Boston Tea Party and the court scene in "The Merchant of Venice" cannot be taught twice in exactly the same way. What the true teacher *adopts* is the *principles* of method; he *adapts* his *method* as occasion demands. "Professional training in education," says Doctor MacVannel, "must aim to give control of the principles or the intellectual methods involved in practice rather than the mere mastery of technic."[1] He whose

[1] MacVannel, "The College Course in the Principles of Education," p. 16.

training gives him this intelligent control need have no fear of losing his personality and becoming a mere machine in his profession. His progress is assured.

2. Basis of Method in Secondary Instruction

Principles of Method.—Do principles of method exist? Is it true that we can find principles which possess general validity for the teaching process, and, if so, what are they, and where are they to be sought? Münch seems to offer an affirmative answer. "Method," he says, "means that which is obtained in clearly defined principles by the consideration, on the one hand, of the laws of the mental life, and on the other of the nature of both content and aim of instruction; it accordingly has equal validity for all instructors." [1] In so far as these laws of the mental life have validity, the derived science of teaching is established as an applied science, not merely as an empirically discovered art. The truth of this position has long since received some recognition in the field of elementary school method, so that to-day there is evident a tendency toward the other extreme, the substitution of formalism in instruction at the expense of personality. In the domain of secondary education, however, the situation is not as clear. Educators are justly in revolt against any attempt to prescribe specific methods or systems of methods according to which the various high school subjects shall be taught. Just as methods vary with teachers and with classes, so they must vary with subjects. It is evidently with this thought in mind that one writer has said: "There is no such thing as a high school pedagogy. It is time all students of secondary education recognize that we must speak rather of high school pedagogies." [2] Yet no one trained in educational thought will question that there are certain principles in accord with which the teacher must proceed if he would suc-

[1] Münch, "Geist des Lehramts," p. 386.
[2] Johnston, "High School Education," p. v.

ceed. The musical composer and the painter, the architect and the teacher are herein similarly situated. The teaching profession must carefully distinguish between the "methods" of teaching and the "principles of method." [1]

Nevertheless, there are not a few to whom "methods" and "method" are synonymous, and in their protest against a study of methods they will have nothing to do with anything that even suggests method. Doubtless the chief cause of this attitude, which is especially common in the universities, is the failure of the college professor, a specialist in a particular field of science, to catch the point of view of secondary education. He thinks of his science primarily as a science, rather than as a means for developing personality; he is absorbed in the science as knowledge, and in fact so teaches it, forgetting the human factor, the student. Indeed, the most frequent criticism offered against the teaching done by newly graduated college students is that they carry over to the high school this point of view of their college study, absorbed from their professors in the university. When the principles of psychology cease to be true, and the aim of education is displaced by the particular aims of the various secondary school studies, each determined solely by the content of the study, then and not until then will there cease to be valid general principles of method in secondary education. But that day is not yet.[2]

The Method of Secondary Instruction.—In the typical school system, adolescent children are found in grammar grades as well as high school, and into the junior high school especially not a few preadolescents find their way. In the main, however, the high school is to be thought of as peculiarly the school of adolescence, and the psychology of adolescence must accordingly play the leading part in secondary

[1] The employment of the word "method" for the great body of method-principles, the science of method, seems justified by common usage, and will be followed in this book.

[2] A further objection to the study of method, based upon the differences of individuals, is treated in Chapter XV, pages 309 *ff.*

method. While not fundamentally different from the psychology of childhood, for adolescence is a development from childhood, it nevertheless represents a later stage of mental growth, with new interests and new distributions of interest and power. However, not merely does the high school boy think differently, feel differently, act differently from his brother in the grades, but he lives in a very different world. His environment has assumed new meanings, and as interpreted in the form of the school curriculum, that environment is differently organized and differently presented. The method of high school instruction, therefore, with the psychology and environment of adolescence as its basis, differs sufficiently from elementary method to justify its special study on the part of the high school instructor. Doubtless many a secondary school teacher can appreciate the author's experience in trying to apply in the high school the only method he could find treated in educational works, viz., elementary method, and then turning in disappointment and disgust from all method as such. The fault lay not in the principles of teaching but in their wrong application. It is the purpose of a course in the principles of secondary instruction not merely to give a statement and exposition of those principles, but also to indicate something of the ways in which they may be applied in the work of teaching. A frequent criticism of high school teachers is not that they are ignorant of the principles of education, but that they have never had their attention called to the practical application of those principles. The aim in the succeeding chapters will be to bring the theory of education in the abstract near enough to the practice of teaching in the concrete to enable the inexperienced teacher to realize the connection between the theory and the practice. The text is intended not as a substitute for experience but as a director and inspirer of experience.

In realizing the aims of education through the teaching process, method must take account both of the student and

of the subject-matter. Of these the latter, with the emphasis upon content, furnishes the basis for the study of special method, and therein is treated more specifically the application of the general principles in the teaching of various studies of the curriculum. Realizing the need for such study, the colleges are offering courses in the teaching of History, of Latin, of Mathematics, and of English. For our present study of the principles of teaching, there falls to us as our field the consideration of those general principles themselves, with the adolescent's intellectual make-up and psychical development as our starting-point. The former, the intellectual endowment and tendencies of the student, might be likened to the forces with which we deal, the component elements in the dynamic system of learning, feeling, and acting. All that the youth thinks, all his attitudes toward the world about him, all his activities are determined by his interests and tendencies, and his educational development is but the unfolding of these under the influence of the environment, whether natural or man-made. The teacher soon learns that interests are not to be created or supplied, but that, actually or potentially, their list is already complete before the student's name is entered upon the class roll. These are the basis of the student's self-activity, and through these alone can the teacher gain access to the inner precincts of the self for the influencing and directing of its development. On the other hand, the instructor realizes that in the functioning of these tendencies, as the child mind develops, certain principles hold, and with these all educational efforts must be in accord. The laws of thinking, of feeling, of acting are pretty well established, and he who would direct the learning process may not ignore the laws of learning. Upon these two foundation-stones—the adolescent fund of tendencies, both native and acquired, and the functioning of these in learning—we must build our superstructure of secondary method. Getting the view-point of the student and directing our procedure accordingly is the first essential in teaching.

3. Summary

Success in instruction involves an understanding of the aim and method of instruction, and skill in the application of method. The true teacher is the one who thus intelligently adapts procedure to aim, recognizing and employing the principles upon which method must be based.

Method is not a slavish adherence to fixed rules of procedure, but is the application of established educational principles to the work of teaching.

QUESTIONS FOR DISCUSSION

1. Examine several books on special methods and see if they seem to advocate *method* or *methods*.
2. Some teachers trust to inspiration alone in matters of method. Into what dangers does such teaching fall?
3. Would it be best for the inexperienced teacher to begin by merely imitating some good teacher, and to trust to experience to produce improvement?
4. Is the difference between elementary and secondary teaching mainly a difference of method or of methods?

SUPPLEMENTARY READINGS

Dewey's article on "Method," in Monroe's "Cyclopedia of Education."
Suzzallo's article on "Method of Recitation," in Monroe's "Cyclopedia of Education."
De Garmo, "Interest and Education," chap. VIII.

CHAPTER II

SOME FUNDAMENTAL PRINCIPLES IN LEARNING

1. The Child's Equipment

Native and Acquired Traits.—The teacher must start with the child as he finds him. When the pupil enters upon his high school career, he brings with him fairly definite and presumably adequate equipment. He has, or rather is, a nervous system which is a storehouse of tendencies and experiences, both racial and individual. At birth he inherited a complex of instincts and native capacities, and during the course of his home and school life those instincts have been developed and directed, those capacities have been partially realized.

Strictly speaking, the pupil is essentially a bundle of activity, of native and acquired tendencies to action. His body is a veritable storehouse of energy, demanding outlet in physical activity, and revolting against restraint. His instinctive curiosity and impulse to know and understand prompt him to extend his knowledge in the fields into which his elementary school training has introduced him. With the development and exercise of the social instinct he demands opportunity for the realization of his social nature. Thus, the basis for all teaching is the activity of the child. All that teaching can do is to induce and direct that activity, and the key-note of our study of teaching method must constantly be the self-activity of the student. If I would have a strong arm, I must move that arm myself. No amount of massaging or manipulation by another will avail unless I myself actively participate. In the school world, as in the physician's office, intellectual massaging will never produce power. The child must be the actor, and the starting-point

of the teacher's efforts must be these dynamic tendencies of the child.

Individual Differences.—But neither by native endowment nor by subsequent training are all children alike. Due to differences of hereditary influence, the various instincts differ in form and strength, the various capacities differ in degree. Different environments and training have in turn accentuated differences of heredity, and have produced infinite variations in their development. Moreover, all these and other factors unite to determine children's future careers and their consequent individual needs. If we are to personalize our instruction, and to teach pupils rather than subjects, the teaching process must ever be adaptive. Without losing sight of the general principles upon which all teaching must rest, we must adapt the application of those principles to the individual traits and needs of our pupils.

2. Interest and Teaching

Importance of Interest in Teaching.—For a century, and with ever-increasing earnestness, educational writers have been urging upon teachers the vital importance of an appeal to the interests of the student. Mr. Dooley's declaration that "it don't make any difference what you eddicate a boy with so long as it's something he don't like" is more practised than preached, and the practice itself is on the wane. The youth whose chief interest is in motors and aeronautics is not likely to experience enthusiasm over the study of classical philology, nor will his attempts to master the latter be nearly so effectual as the same degree of energy expended upon the applications of physical science. Moreover, in his study of either, he is entering what is to him an unexplored region. All is comparatively new and strange, and unless he is provided with a guide-book, not to do his seeing for him but to direct his eyes to the things worth seeing, much energy will be wasted and many valuable lessons will go unlearned.

The Inducing of Interest.—Thus the teacher has a twofold function. First, we say, he must *induce* interest in the school work. But in terms of classroom instruction, what does this mean? And just how is it to be done? In the first place, the teacher must so present the material of instruction that it will offer the student a real problem, one that has a direct and obvious function in his life, and appeals to him as worth while. It is not enough that the teacher know it to be worth while, although this is necessary, since a what's-the-use spirit on the teacher's part produces a no-use attitude in the pupil. To the student himself the appeal must be real and conscious. Each topic, each problem must be so opened to him as to fit a need in his life, a need of which he may hitherto have been unconscious, but which he now feels to be real. This is not preaching a doctrine of "soft pedagogics." True pedagogics are never "soft," but are founded upon the exhilaration of work, purposive and earnest work, and neither drudgery nor trifling. What is needed in life to-day is not a readiness to expend our energies upon what appeals to us as useless, but the ability to recognize the useful when we meet it, and having recognized it to make it our own. Tom Sawyer, selling to his playmates the privilege of whitewashing the fence, was exercising a pedagogical talent. But the teacher must do more than sell privileges and take pay in apple-cores. He must be sure that the thing to be done is really worth to the student the effort involved. Too often it is *not* worth while, and yet oftener the worth is not clear in the teacher's mind.

Yet it must not be imagined that the student will always be quick to appreciate the value of all that the curriculum offers. The value to him of his Latin conjugation or of the scientific name of the dandelion may not be fully obvious when first encountered. In practically all cases, however, the skilful teacher will find means to take over interest from some related topic already interesting, or even, by the contagion of his own interest, induce an interest in the thing in hand. In the words of Professor De Garmo, "we must

arouse interest in the subjects now uninteresting, not alone through charm and skill, but also by showing how these subjects contribute to ends in which interest is already aroused. This is interest by induction; it is more potent in higher than in lower grades. It should be possible to arouse the interest of a high school student in any subject that is plainly contributory to the purposes he has already formed. Though such an induced interest might be called indirect, yet there is a good prospect that it will become direct and independent, provided the subject is well taught." [1]

Finally, and perhaps most important, in the inducing of interest, appeal must be made to the active participation of the student. That interests us most in which we have a real part; in which *we* really do something. Call upon the uninterested boy to come and help you adjust the apparatus, and the truth of what we have just said will need no further verification. The wise teacher will find opportunities, or if necessary make them, for giving his students an active part in what is going on.

Thus the induction of interest may well be sought in these four ways: give a real problem, be interested, build upon existing interests, and provide for participative activity.

The Directing of Interest.—The second function of the teacher is to *direct* the student in the pursuit of his interests. Entering a strange territory, the curriculum of the secondary school, and knowing but little of the destination to which the various paths lead, the pupil is almost as likely to choose the wrong path as the right one. His choice will be governed by merely immediate interests, since ultimate ones cannot function. Many a topic in history, science, or English, potentially of absorbing interest, is lost to the pupil because he fails to notice its significance. Here he needs the guidance of the teacher, who knows the field and whose judgment is based upon experience and training. The word to the instructor, therefore, would be this. First determine the prob-

[1] De Garmo, "Interest and Education," p. 120.

lems and situations that are vital to the student; those which are of real value to him, especially in view of his past experiences and present interests. Then, by giving due prominence to those elements and their value to the student, lead him on through his present interests to the solution of the new problems and reaction to the new situations. In this guidance the teacher must inspire his charge to co-operative activity, he must lead rather than carry, and must show the way only when the youth is unable to find it for himself. He must not forget that it is in the finding and not the having found, in the process rather than the product, that the value of instruction is realized.

3. Attention and Teaching

Importance of Attention in Teaching.—It is but to deduce a corollary from the above to say that we cannot teach without attention, for attention and interest are inseparable. Not a few psychologists employ the terms interchangeably. "The term 'attention,'" says Miss Calkins, "is a psychological synonym of the expression 'interest.' To be attended to means precisely to be interesting."[1] The lecturer who cannot hold the attention of his audience is one whose lecture does not interest them. The teacher who declares, "I know that I could interest my class if they would only pay attention!" is mistaken in her diagnosis of the situation, except perhaps that the pupils find something else so much more interesting than the lesson that they choose the former unless forced to refrain. If one would have his class truly attentive, he must interest them.

Attention involves the reinforcement of one idea at the expense of other ideas, which are accordingly inhibited. But this reinforcement and this inhibition are not always easy. There are varying degrees of appeal, both of the one idea to be reinforced and of the others to be inhibited. The former

[1] Calkins, "Introduction to Psychology," p. 137.

may have only an indirect interest, while the latter may, for various reasons, be highly insistent and irrepressible. Accordingly, we find wide differences of degree of effort in attention, ranging from the comparative ease of passive or primary attention to the greater stress of active or secondary attention. The former is necessarily more complete and concentrated, and what is learned by passive attention makes a deeper and more lasting impression. However, in school work it is usually unattainable. At best, the subject-matter has usually only an indirect appeal, and the pupil's attention is rendered only through effort.

Not only in the school but in later life the ability to give intensive and sustained attention is essential for the highest efficiency. The school-child or the professional man who is able to concentrate his mind upon a single idea or line of thought is the one who will really accomplish things. This ability is largely the product of training. Teachers have always realized the importance of attention as a condition in discipline: too little we recognize the demand for its training as a part of every child's right and every teacher's duty in view of the demands of post-scholastic life.

The Securing of Attention.—To establish the importance of attention no further proof is demanded. The question rather is how the teacher shall secure it, and to this the answer has largely been implied in the foregoing paragraphs. From what has been said, it must be inferred that the prime condition is interest, and the rules for inducing and directing interest apply with equal validity to attention. To these, however, some supplementary suggestions may well be added.

Since much of the content of school instruction has only a mediate appeal to the pupil, or its real interest is not immediately evident to him, active attention must be employed. This involves, as we have seen, the reinforcement of the one idea and the inhibition or neglect of others. For the accomplishment of the latter mere prohibitions are of little avail. We must not say to our class, "Now, don't think of so-and-so

and so-and-so," for in so doing we but reinforce rather than inhibit thought where it is not wanted. Rather we must seek to prevent these ideas coming into consciousness at all. The chief function of classroom management is to prevent the occurrence or existence of conditions which might attract attention to themselves and away from the topic of the instruction. Thus, all such distracting influences as disorder, public disciplining in class, physical or mental discomfort, and hostility toward teacher or school are negative forces in teaching largely because they insistently demand attention to themselves. So instead of saying "Don't think about those things," we must say "Think about this thing," and must see to it that there is some definite and attractive feature of it pushed forward for attention to centre upon. Positive incentives avail infinitely more than do negative ones.

Thus, most of our teaching must start with active attention. But it must not stop there. The content of instruction must have in it something of real value and ultimate appeal to the pupil if it is to render him lasting service. We must build up our active or secondary attention into a secondary passive or derived primary attention. That is, we must strive to bring the student to such an understanding of the content that its value to him is more clearly seen and immediately felt. That which he attended to merely as means to end must ultimately hold his attention because of what it really is to him. Otherwise, it slips from his mind as soon as the end to which it was a means has ceased to hold him.

What we have said must not be interpreted to justify a weak do-as-you-please attitude on the teacher's part. Schoolchildren are immature and inexperienced, and need both the reinforcement of authority and the guidance of broader experience. Often, therefore, we must insist upon attention. "You must attend" is an appropriate phrase in the school when "Let's consider so-and-so" proves inadequate. But let us as soon as possible advance from the first to the second,

from external authority to self-control, from teacher activity to student activity, from active to secondary passive attention.

4. Associative Learning[1]

Nature of Association.—In the course of our every-day life all our experiences, whether simple or complex, come to us as discrete units, one by one. But if they are to have any significance for us, if we are to learn, associations between experiences must be set up. The child will never learn to walk save by associating sensations of eye and pressure with muscular movements. He will never learn the capital of England except by the association of the ideas "capital of England" and "London." He will never form the habit of saying "Thank you" unless there is set up an association between the act and the situation which demands it.

It is a matter of common observation that ideas or acts which have once occurred together tend thereafter to recur together: that the mind naturally forms associations of elements that have once fallen together whether through chance or relationship. Naturally, then, upon the teacher devolves the task of controlling these associations: of setting up and encouraging desirable associations and preventing undesirable ones. Teaching the child the capital of England involves the securing of such conditions that it will be associated with London and not with Paris or Berlin. This control of conditions for the formation of associations of thought, of feeling, and of action, constitutes by far the major part of the teaching process.

Securing and Controlling Associations.—The rules for controlling the conditions of association, though wide their application, are fundamentally the two implied in the pre-

[1] Possibly the best discussion of association and dissociation in their educational bearings is that by Thorndike in his "Elements of Psychology," chaps. XIII and XIV, and his "Principles of Teaching," chaps. VIII and IX. Our own discussion follows in the main Thorndike's treatment of the topic.

ceding paragraph. First: determine how you wish the elements to be associated, and see to it that the student encounters them in that arrangement, repeatedly and invariably. Second: once the association is formed, reinforce it by encouragement, making it worth while to the pupil. And, negatively stated, discourage the undesired association by making it unprofitable.

In a Latin class these rules were applied in this way. The class had placed upon the board a portion of a verb conjugation. As soon as each pupil's work had been considered, it was left upon the board if correct; but if incorrect it was erased, and the correct form, written three times, was substituted by the student. Thus the correct association was allowed constantly to establish itself in the minds of the pupils during the remainder of the hour, the incorrect one was removed as a possibility; the former was encouraged, the latter discouraged.

A chemistry instructor wished to teach his class the lesson that seemingly trifling differences in composition are important to the chemist. Instructing his class to treat a small quantity of KCl with H_2SO_4, he set out on the supply table, in addition to the H_2SO_4, bottles of both KCl and $KClO_3$. From the successful experiments of those who were exact, and the violent chemical action and broken apparatus of those who used $KClO_3$, the class learned the lesson of exactness. The instructor had so arranged his conditions that accuracy became strongly associated with chemical procedure, and impressed the lesson by encouraging the desired and discouraging the undesired associations.

Association after Dissociation.—The associations of which we have been speaking were of the simple, immediate type, in which the association was of elements taken as they presented themselves, unchanged by any preliminary mental activity. Not all association, however, is of this type. "The truth is," says Professor James, "that experience is trained by both association and dissociation, and that psy-

chology must be writ both in synthetic and analytic terms." [1] On a higher intellectual plane and involving a more complex mental functioning than the other is the type known as association after disjunction. A concrete illustration may render explanation easier. The student of geometry is studying about polyhedral angles. He is told that the corner of a box, the apex of a square pyramid, and the apex of a hexagonal pyramid are such angles. By a process of analysis, he abstracts the feature common to all these cases, and then synthetically builds up the concept of polyhedral angle. Thus we have a case of analysis followed by synthesis, or association based upon dissociation.

All stages of learning, and especially the more advanced, abound in mental activity of this type. Whenever the pupil, confronted by a series of situations having a common factor, analyzes out that factor and forms therefrom a new and unitary concept, distinct from the particular instances in which that factor occurred, the process is that of association after disjunction, or association based upon dissociation. In this the distinguishing feature is the analytic activity, which is almost or wholly absent from the simple association. It is this process of analyzing situations into components, and the recognition of the identity of elements in situations, which gives it its superiority over simple association as a learning activity.

All reasoning is based upon association after analysis. When the student concludes from the form of a mound that it is of glacial origin, he first analyzes out from the total situation those features which he has found to be common to and characteristic of glacial mounds, and by association concludes glacial formation for the mound before him. His demonstration of the proposition that the bisector of an angle bisects the subtended arc is based upon analysis of the qualities of the bisector of the angle and of that of the arc, and the inference from the one to the other based upon the common essential element in both.

[1] James, "Psychology," vol. I, p. 487.

What is the teacher's function in securing this dissociation-association activity? What are the conditions under which it can best occur? Obviously, the rules which have already been given for simple association apply with equal validity for the association which follows the disjunction. For the dissociative activity the following suggestions are offered. In the first place, the cases from which the dissociation is to occur must be such that the element to be dissociated is fairly conspicuous and easily distinguishable. Here the teacher must realize that what appears prominent enough to one who has already noticed it may easily escape the first glance of another person. It naturally follows that the conspicuity of the element can be much enhanced by directing the attention to it as the various cases are studied and compared. To build up the concept of the representative basis for taxation, it would be unwise to choose instances wherein the application of the principle is interwoven with a variety of other complicating elements. In the second place, the cases upon which the dissociation is to be made should involve different combinations of the element to be analyzed out. For example, using again the illustration of the polyhedral angle, it would be far better to derive the concept from such cases as the apex of a square pyramid, the corner of a cube, and the apex of a hexagonal pyramid than from several trihedral angles only. A third rule tells us that, as soon as the dissociation is once started, the dissociated element should at once be associated to some name or symbol. The derivation of the concept of the polyhedral angle cannot proceed far unless the name for the concept is early introduced. Thus, the name serves to focalize the attention in the analysis, and to render the concept definite and usable. Finally, the abstraction should be rendered permanent and its implications broadened by its application to further concrete cases. When the student has gained the concept of representative taxation or polyhedral angle, he should apply that concept to instances other than those from which it was derived.

In the present section we have endeavored merely to give a general statement of the principles of association and dissociation. In subsequent chapters we shall see how most of our teaching involves an application of these principles. In the study of the recitation mode we shall find that both memory-forming and habit-forming are essentially types of simple association. In the discussion of the problematic mode it will appear that the finding-out problem and the thinking-out problem are based upon simple association and association after disjunction respectively. The teaching of appreciation, as we shall see, must recognize the association of feelings with ideas, and the importance and conditions of the control of such associations. In the expression-application mode and the laboratory mode, various applications are made of all the laws of association and dissociation. To no inconsiderable degree, the problem of the succeeding section is related to that of the present one.

5. The Transfer of Acquired Efficiency

The Basal Principle in Transferrence.—Until comparatively recently it was imagined by many that the mind consists of certain general powers or faculties, such as memory, reasoning, and imagination, and that the training of one of these faculties upon one form of content would constitute a training of it for other more or less dissimilar content. For example, it was thought that the training of the reasoning power in geometry would effect its training for science or history or even for the every-day reasoning of the commercial world. In a similar way, examples of supposed transferrence of training might be multiplied: perception of Latin verb endings leading to perception of characteristics, memory for German genders leading to memory for historical chronology, imagination in geometry leading to imagination in English composition. Thus accuracy, neatness, promptness, regularity, and the entire list of school virtues could, it was sup-

posed, be so developed in the school as to function in the home, the shop, the street, or adult society generally. Prevailing conceptions not of curriculum alone but of instruction as well were based upon this assumption of the transferrence of training. So deeply was the belief rooted in educational procedure that despite various and repeated attacks upon it by students of education and psychology it is even to-day implicitly basal in curriculum and method in schools and colleges.

Possibly its tenacity of life is due in part to a measure of truth which conservative opinion dislikes to abandon and which recent investigation seems to confirm. What is that truth, if truth it be, and what its significance for methods of instruction? The limited scope of this book precludes more than brief and somewhat general answer to these questions, and especially to the former.[1] Psychologically speaking, learning involves the forming of a connection between a situation and a response. Some concrete examples may assist us in our interpretation. In learning the factoring of $a^2 - b^2$, the gender of *Klugheit*, or the typewriting of the word *and*, the situation involves the recognition of the expression $a^2 - b^2$, the word *Klugheit*, or the word *and*, and connected as response to it the conscious want of the factors of the expression, the corresponding gender, or the appropriate manipulation of typewriter keys. Simply illustrated, the transfer problem might in this case be, Does the training in the factoring of $a^2 - b^2$ assist in learning to factor $x^2 - y^2$ and $a^3 - b^3$? Does the learning of the gender of *Klugheit* assist in the learning of the gender of *Schönheit?* Does the skill in typewriting *and* facilitate the learning to typewrite *for?* If the answers be affirmative in the above cases, with seemingly very similar content for the transferrence, how far does the

[1] A better statement of Thorndike's view is to be found in his "Educational Psychology," vol. II. A different point of view is that taken by Judd in his "Psychology of High School Subjects," chap. XVII. Starch's "Educational Psychology," chaps. XIII and XIV, gives possibly the best general exposition of present-day opinion on the subject.

training carry over into more dissimilar situations? In most of our learning, the composition of the situation is very complex; more so, in fact, than is commonly realized. Moreover, seemingly similar situations may really be similar in only a few of their components, dissimilar in other and vital points. Conversely, seemingly dissimilar situations may be dissimilar in but a few of their elements, and similar in the others. It is on this identity of elements that the truth of the transferrence of training depends. Briefly stated, the belief of Professor Thorndike is this: transfer of training occurs only to the degree that the old and the new have common elements. In learning the factoring of $a^2 - b^2$ the boy may learn it as the method of factoring the difference of two squares, or as the factors of the particular expression $a^2 - b^2$. Confronted with $x^2 - y^2$ there would in the former case be the recognition of it as the difference of two squares, which would thus provide the common element between the two situations, and the learning from the first would carry over to the second. However, if he has learned merely that the factors of $a^2 - b^2$ are $a - b$ and $a + b$, the $x^2 - y^2$ situation will present to him no element from the $a^2 - b^2$ situation, and its solution will necessarily be learned *de novo*. The principle involved in this very simple case holds good, we are told, in the more complex learning activities. In each of the instances mentioned in this and the preceding paragraphs, as well as in all forms of learning, that which is learned, whether knowledge or process, is serviceable in new situations in proportion to the degree of identity of elements in the old and the new situations.

The fundamental principle involved is really that of association after dissociation. In teaching the factoring of the difference of two squares the instructor confronts the pupil with a number of cases: such as $a^2 - b^2$, $c^2 - d^2$, $r^2 - 4$, etc. In each case, attention is called to the one feature common to all: viz., the fact that each expression is the difference of the squares of two quantities and factors into the sum and

difference of the quantities. In each case there occurs an act of dissociation and following this comes the act of association of all in the form of a generalization. The boy may become able to factor $a^2 - b^2$ into $a + b$ and $a - b$ a thousand times, but without this dissociation-association process, without this generalization, the power acquired will never be transferred to other expressions. Similarly, it has been shown by Bagley[1] and others that merely teaching children to be neat in their arithmetic papers produces no real effect upon the neatness of other written work. Only when the particular quality of neatness is isolated and dissociated from arithmetic papers as such, and generalized in an application to papers and written work in general, will transfer of training occur.

Pedagogical Applications of the Principle.—The principle of the transferrence of training as thus stated is comparatively simple. Its implications and applications in the problems of teaching are quite the opposite, and as yet little has been done in the way of educational reconstruction in the light of the principle already agreed upon. For our purpose it will suffice to suggest three ways in which the teacher, especially in the secondary school, must recognize the principle in his instruction. In the first place, in deriving a concept, either of knowledge or of process, the derivation must be made not from one concrete case but from a wide variety of cases, since otherwise the student will, as in the factoring illustration above, connect the response learned with the single situation as a whole instead of with the common essential of all, and thus be unable to carry over his learning to other situations involving that element, though different in form. The immature mind is incapable of analyzing a single instance sufficiently for the dissociation of an abstract quality as the basis of a generalization. The second suggestion, following directly from the above, is that the meaning rather than the mere form of what is learned shall be at the basis of the learning.

[1] Bagley, "Educative Process," p. 208.

Situations with identity of form are rare; those with identity of meaning as regards the essential elements are many, and the degree to which learning can be transferred depends upon the degree to which the student can recognize identity of essential elements in the situations. Thirdly, applications of the principle or process should be varied, thus injecting into the learning a training in looking for identity of essential elements between the familiar situation learned and the wide range of situations to which the learning can be applied. Further applications of these three suggestions will be made later in our study, especially in the chapters on the problematic and the application modes of instruction.

Writers both on general and on special method are frequent offenders in the violation of these principles. Method texts, including some even recently published, abound in references to the training of the observation, the memory, the reason, in a general way, tacitly assuming an identity in the observation of chemistry and of German, in the memory of history and of Latin, in the reasoning of geometry and of physics. On the other hand, the writer on special method often falls into a somewhat similar error in failing to provide for the identification of common elements of learning in his own special field and in other seemingly dissimilar fields. A further correlation of studies in the curriculum will tend to remedy somewhat the last-named fault. It should, however, be the peculiar function of general method to call attention to the fact of the potential connections between different fields, as regards transferrence of training, and to the modes of instruction whereby these potential connections are brought to consciousness and made to function.

6. Summary

Instruction must be based upon the child's equipment, both native and acquired. This consists essentially of tendencies to action, in which individuals differ more or less widely.

The teacher must induce interest in the material to be taught, by realness of problem, interestedness, building upon existing interests, and student activity. He must so direct the student in his study as to interest him in the best things, by leading him to discover in the content of instruction the elements which have a real significance to him.

Without attention, learning would be impossible. Although passive attention is most effectual for learning, active attention is usually a necessary stepping-stone to it in the school.

Learning is largely a matter of either simple association or association after dissociation. These are particularly fundamental in habit-forming, memory-forming, discovery, and reasoning.

Training acquired in one intellectual field can be transferred to another field only in so far as the two fields have common elements. Hence, the derivation of concepts should be made from a wide variety of cases, the meaning rather than the form should be made the basis of connections, and the principles or processes should be given a wide variety of applications.

QUESTIONS FOR DISCUSSION

1. Mention several influences of the elementary school environment which would produce differences of mental endowment on the part of pupils just entering high school.

2. Are the differences of endowment of the pupil to be viewed as advantages or disadvantages? Why?

3. Some tell us that life abounds in uninteresting but necessary things, and that the school's appeal to interest is wrong in that it does not train for the actual conditions of life. Criticise the argument.

4. How would it do to let the pupil select for study just those studies and topics that interest him?

5. The uninteresting but important things of the curriculum should be "made interesting." Analyze and criticise this proposition.

6. Attention is purely spontaneous, and as such cannot be trained. Criticise this argument.

7. Suggest some student offenses which should be dealt with at

once, to prevent distraction of attention; some the treatment of which should be deferred for the same reason.

8. Give concrete illustration of how active attention may develop into secondary passive attention, as the result of study in the high school.

9. Suggest conditions under which the teacher is wise in resorting to insistence on attention. Conditions under which such resort should be unnecessary.

10. What is the type of association involved in the following: Learning to spell? Learning the principal parts of an irregular verb? Learning the principle of the artesian well? Learning the demonstration of a geometrical proposition? Suggest other examples of each type of association.

11. An instructor in zoölogy, desiring to teach the principle of protective coloring, used two illustrations: the striped body of the tiger and that of the zebra. Criticise the procedure.

12. If you were endeavoring to develop patriotism by the teaching of the career of Nathan Hale, how would you make sure that the patriotism lesson was really learned?

SUPPLEMENTARY READINGS

Bolton, "Principles of Education," chap. XXVI.
De Garmo, "Interest and Education," chap. VIII.
Thorndike, "Principles of Teaching," chap. V.
Colvin, "The Learning Process," chaps. XVII, XIX.
Thorndike, "Principles of Teaching," chaps. VIII, IX, XV.
Judd, "Psychology of High School Subjects," chap. XVII.
Henderson, "Textbook in the Principles of Education," chap. X.
Colvin, "The Learning Process," chap. XIV.

CHAPTER III

AIMS IN INSTRUCTION

1. Educational Aims

Aims of Education.—Intelligent procedure presupposes a conscious purpose. If unanimity in formulation of its aim were an essential in education, the outlook would be most disheartening. Modern writers seem to vie with one another in their search for a new way of telling us what education is and what it should accomplish.

Yet, despite this seeming disparity in statement, we cannot escape the conviction that as regards the qualities of the finished product of education there is really no vital disagreement. The high school graduate who would receive the stamp of approval under one standard would be readily accepted by the others as educated. Modern thought is in virtual agreement in stating the aim of education in social terms. We are told that the individual must be socialized, that he must be introduced into society, that he must attain social efficiency, etc. Moreover, secondary education has a distinctive function which elementary education shares only incidentally. Society expends its resources and energies upon the high school pupil with the idea that he will attain to a broader interpretation and function in society than that for which the elementary school can prepare. The product of secondary education shall be a leader, able and disposed to direct and inspire his less favored fellows and to contribute a social service to which they cannot attain. He must be trained to function in society as a leader in its various activities and institutions. As a member of the body politic he must understand the institution of the state, and be able and

disposed not alone to vote intelligently but to serve the community in official capacity when needed. From the economic side, he must be not only self-supporting, but able to contribute to the world's wealth by leading in its production and distribution. In all forms of social activity he must be a person of broad sympathy, able to correctly interpret and evaluate movements for social welfare and to lead in them. He must have a real place in the culture of the race, appreciating and so far as possible contributing to the æsthetic, religious, moral, and intellectual possessions of mankind. Finally, his power and disposition to think and feel and act in these social ways must be so established that they can be depended upon to function as occasion demands.

Aims of Instruction.—Thus education, and in a peculiar way and degree secondary education, must aim at social intelligence, social disposition, social efficiency, and social habit. As instruction is the school's way of securing these aims in the individual student, they must have an immediate bearing upon the aims of instruction. To be socially intelligent, one must know his human and his physical environment, possessing not only adequate information regarding it and appreciation for it, but the intellectual power of thought, judgment, and imagination for its interpretation and improvement. The socially disposed individual is the one in whom has been developed the feeling for social interests and welfare, who has been sensitized to his environment, so that it is to him not only a matter of intellect but an object of real appeal demanding a response. Social efficiency is the capacity to bring intelligence and disposition to bear in social action, involving initiative, will-power, habit, and skill. Social habit is that fixity of character which comes from repeated social action, and which tends to insure its continuance. It is the school's task to develop these qualities through the process of instruction. Accordingly, if we would enumerate the aims of instruction, the list might well include the following: (1) Knowledge of one's self, of one's environment, and

of the relation between the two. (2) Power to think, with trained judgment, reason, and imagination. (3) Sympathetic feeling toward the environment, in its truth, its beauty, and its moral implications. (4) Ability for self-expression, in word and act, under the guidance of this knowledge and thought and the impulse of this feeling. (5) Steadiness and permanence of character in thought, feeling, and conduct, and the conservation of attainments.

2. Essentials and Factors of Instruction

The Essentials of Instruction.—School instruction, in order to be adequate, must meet certain requirements; it must secure certain results on the part of the pupil. In the first place, it must produce knowledge. The student must become informed about the ideas that do or should play a part in his individual and social experience; with the most common and fundamental of these he should become familiar, so that he not merely *knows about* them but *knows* them, and he must know how to deal with all these things intelligently.

Secondly, it must train in thought power. The activities of life demand the constant interpretation of the things and situations encountered. Judgment, reasoning, and imagination are the activities that give meaning to the known, and extend the real to the realm of the ideal.

The third requirement is that the development of sentiment shall be provided for.[1] Adolescence is a period when the boy and girl feel most deeply. Likes and dislikes, admiration and repulsion, aspiration and disappointment play a large part in adolescent development, and the education which ignores or misinterprets these impulses is not merely wasteful but often negative in its results.

A fourth requirement is efficiency. Of what use to know

[1] The use of the term "sentiment" where the word "emotion" is usually employed will find its justification in Chapter IX, p. 173.

much, to feel deeply, when one cannot express and apply what is thought and felt? How much is said to-day of the student who in the physics class cannot use the simpler formulas of mathematics, or who with all his knowledge of rhetoric and composition cannot write a creditable letter to his parents! Moreover, he should be able to work for and with others as well as individually. Individual efficiency must be the foundation for social efficiency.

Fifthly, the results of teaching should be permanent. The structures we build are not for a day but for a lifetime, and demand lasting foundations and well-built superstructures. Herein, present-day results are far from satisfactory. The average high school graduate, after five years of non-scholastic activity, would experience no little embarrassment if suddenly called upon for more than the most fundamental facts and processes of his history and mathematics. While it is true that not a few of the facts learned in school are intended merely as a scaffolding in the educational structure, and having served their purpose lose much of their value, still most of the knowledge and power acquired in study has permanent value, and its loss, due in part to poor teaching methods, represents a serious waste in the educational economy.

Factors of Method.—An adequate scholastic training, therefore, must secure these five results: knowledge, thought power, sentimental development, efficiency, and permanency. How is this to be accomplished? In terms of pupil and teacher, of classroom instruction, what are the forms of activity whereby these requirements shall be met? For our answer we must look to the student's interests, thoughts, and needs, and the forms of activity whereby these can be made to function for his educational upbuilding. Convenience of classification leads us to suggest six such forms or phases of the work of instruction, based upon the type of student activity involved and the aim sought. Convenience of nomenclature leads us to call these the six factors of method,

since ultimately the whole teaching process is but a product of these six and can be resolved into them.

In the first place, we find the interest of curiosity functioning in the acquisition of information. The student wishes to know facts, even though their immediate value be of little or no concern to him. It is nature's means of first introducing the world to the child. Obviously, this acquisition is the first and most fundamental factor in the learning process, and out of it the other factors must follow. The time is not very far past when this one activity was considered practically the sole element in education, and educational efficiency was measured in terms of the amount of information of a given sort the student possessed. Examinations consisted of questions the answers to which were merely a matter of memory, usually of the mechanical sort. It is our purpose to-day, in principle at least and increasingly so in practice, to recognize that this acquisition factor is but one, though an important one, in learning.

Not merely must the student acquire information, but he must follow it up with reflection. When he has found out something, he must think about it, investigate its implications, and its relations to what he already knows, and give it a place in his intellectual world. From the world of the known and actual he must by imagination construct the realm of the new and ideal. Reflection is that phase of knowing in which the interest of mental activity is especially prominent. In the well-conducted class exercise no small part of the teacher's work is to stimulate to reflective activity, in question and answer, comparison, discussion, and a multitude of other types of activity. Merely encouraging the class to remain silent and think is a device too little employed for the stimulation of reflection. Yet reflection never takes place aimlessly and without a recognized situation which it tries to interpret. It is never mere meditation. Simply saying to the student, "Now, think! think!" is useless unless he is given something to think, some problem to solve. Reflec-

tion starts in a conscious purpose, and, in Dewey's words, "his reflection is aimed at the discovery of facts that will serve this purpose. . . . Demand for the solution of a perplexity is the steadying and guiding factor in the entire process of reflection."[1]

The purposiveness of discovering and thinking suggests the third stage in the learning process, the stage of expression. Not merely does the student like to find out and reflect, but his next impulse is to *do*, to act upon his idea. The wise and venerable maxim, "No impression without expression," is a trustworthy witness to the fact that thought which does not culminate in action, either immediately or ultimately, has but little pedagogic value. The interest of the practical, the desire to act upon his impulses and to give expression to his ideas and impressions, is one of the strongest forces in the adolescent nature, and the teachers who do not utilize it in their work will soon find that the ideas and impressions so zealously developed fade away for want of exercise. True mastery of the formula for the area of a triangle, the French equivalent for an English idiom, and the law of the pendulum, is effected only by finding the area of a triangle, using the French expression, and experimenting with a pendulum. It forms the completion of the learning process, which we may say consists of the three factors of acquisition, reflection, and expression.

The method factor which is doubtless the most neglected of the group is the appreciation factor. Too widely the impression prevails that learning only is the work of the school, and that the sentimental life of the adolescent is a matter with which the teacher has no official concern. Doubtless the study of literature is the only conspicuous exception, and it is just because literary study cannot be carried on by the learning method employed in other fields that it has been found so difficult to teach. The interest of the sentimental is rather repressed than furthered by the methods of study

[1] Dewey, "How We Think," p. 11.

employed in securing knowledge, but demands a type of procedure in harmony with its character.

The four factors already considered are those which function in the interpretation of a reaction to *new* situations. The material dealt with is in each case a content as yet undeveloped, or, in the language of the school, is advance work. However, the pedagogical requirement of permanence of acquisition demands an additional factor, whose material is the old and familiar. This factor we shall call drill. As the first four factors had a forward movement, we have here what might be called a circular movement, wherein the path carries us round and round upon the same material over and over again. If ancient lineage is a basis for aristocracy in the pedagogical world, drill is indeed well born, for one of the most striking characteristics of the early educators was the thoroughness of their instruction. True, drill has fallen rather out of fashion for a time, but a more conservative movement has again set in, and the favorite of the earlier days is again coming into its own.

If the three first-named factors of method be said to have a forward movement, and the drill a circular movement, we might ascribe to our sixth and final factor, testing, a backward movement. As drill is a reiteration of subject matter and processes as they are being developed, testing is a recall of the content of earlier study. Its material is the same as that of the learning process, but it is for a far different aim. The old typewriter with the writing concealed was succeeded by the visible writer of to-day because the typist could do her work more confidently and accurately when an occasional glance at the paper would show what had already been written; so, when the teacher knows how his instruction is succeeding, and wherein his work needs correcting and his methods revising, his efficiency is correspondingly increased. He therefore finds it necessary to test his pupils at suitable intervals, to discover to himself (and them) whether they are making the progress they should make, and wherein to alter the method of procedure.

Thus we have analyzed the student activity, as controlled by the teacher, into six forms which we take to be the six factors of method: acquisition, reflection, expression, appreciation, drill, and test. In the succeeding chapters the interpretation of the teaching process will be, either implicitly or explicitly, in terms of these.

3. Importance and Character of the Lesson Aim

Teacher's Aim.—Probably the chief characteristic of progressive method and the one which gives it its superiority over mechanism in teaching is its consciousness of an aim which permeates every phase of its activity. The teacher who goes into the classroom without a definite purpose which the class exercise is to realize will at the close of the hour look back upon a series of disconnected, ineffectual efforts. The pupil who, during the class exercise, has no consciousness of what it all means and whither it leads will take no vital interest in his work. For both teacher and pupil, the work of such an hour has degenerated into drudgery.

A definite aim on the part of the teacher, a consciousness of the "why," is essential to both the "what" and the "how" of his work. In his organization of subject matter for the lesson he can by a process of selection and rejection, of emphasis and subordination, construct a consistent and orderly plan in which each element contributes its part to the development of the thought. The distractions due to irrelevant matter, suggested by his own imagination, by outside sources, or by the class, can be eliminated. When the purpose demands something not already at hand, some of those seemingly unimportant side lights which contribute so much toward making a suitable stage-setting, the need is at once brought to consciousness and its object supplied or improvised. Further, his method of procedure will be varied to meet best the need of the class exercise. The teacher who at each step of his procedure has in mind the function of that step is able to carry out that purpose better because it is done

intelligently, not imitatively, and accordingly he can adapt the developments of the classroom, both anticipated and unanticipated, to the realization of his aim. Moreover, the teacher's own mood of confidence is furthered by a conscious purpose, and this mood is one of the chief qualities of leadership.

Student's Aim.—The advantages for the student of a conscious and definite aim in his lesson have been stated by Rein[1] as essentially the following: (1) Definiteness of purpose assists the pupil to turn his thought from irrelevant interests and to concentrate his attention upon the business in hand. (2) It creates in the student's mind a situation which is intelligible and real to him, and to which he readily reacts. (3) It arouses the mood of expectancy. (4) It insures a community of interest between pupil and teacher, thus enlisting the attitude of co-operative student activity. The importance of this intelligent participation and co-operation of the student in the class exercise cannot be overemphasized, for without it teaching sinks to the level of "school-keeping," and learning becomes mere mechanical memorizing.

Character of Aim.—The teacher's statement to his class of the aim of the class exercise for the day receives much attention in Herbartian literature. Naturally the ideal method is for the student to encounter a need in his study or class discussion, to come to realize that need as one worthy of his attention, and to formulate it as a task for the class to help him master. In such a case, the teacher usually assists by directing the student to the discovery of the need and assisting him to a good formulation of it. Even primary pupils can be led to feel a considerable degree of purposiveness in the lessons assigned them, and to respond to an appeal for co-operation. In a much broader way and to a far greater degree, the same response is attainable in secondary education. In the first place, the aim is of a kind to appeal more strongly to the advanced student, since it is to a greater

[1] Rein, "Pädagogik in Systematischer Darstellung," II, p. 509.

degree a matter of knowledge and feeling, rather than skill, whose value is more indirect and remote. Moreover, even when the elements of drill and testing are introduced, the older student is more willing to work for these ends, since the remoter value has more appeal to him than to a younger child. It is natural, therefore, that the more advanced the grade of work, the more the teacher's aim and the student's aim should tend to coincide, and the more naturally and completely the aim of the lesson can be developed rather than told to the class by the instructor.

The chief essential is that so far as possible the aim develop naturally, rather than be manufactured artificially, and that it be a real need appreciated and responded to by the student. Whether first formulated as a statement by the teacher, a question addressed to the class, or a problem raised by the class, is of less concern, so long as it is of a character to arouse the activity of the student. Indeed, the zest of the unexpected may occasionally be utilized by suggesting at the beginning of the class exercise a problem which is but a kind of anticipation, opening up into the real problem as the lesson proceeds. Adams gives an illustration of such.[1] "Instead of starting straightway with the subject of the difference between the development of the Feudal System in England and in France, the problem might be suggested: Why are there hedgerows in England and not in France? In answering this interesting question all the essential points of difference emerge, and the incentive of a well-defined purpose is maintained throughout the lesson."

A lesson aim always involves two terms, the subject matter and the teaching activity that corresponds to it. When a rule is memorized, a problem solved, a poem studied, or skill in a process secured, there is first the content, whether rule or problem or poem or process, and second the method factor or factors whereby the content is rendered educative for the student. With the content of the rule for the transposed

[1] Adams, "Exposition and Illustration," p. 182.

word order in German go the acquisition, the expression, and the drill. The study of stream erosion or of the Bunker Hill Oration involves the acquisition, the reflection, and the other method factors which the teacher may choose to employ. Thus, the aim of a lesson is secured by the adaptation of process to content. But the subject matter of the high school curriculum is far from simple. Almost every lesson aim is attained through the realization of subordinate aims. Practically every process is a complex one, involving several minor processes. It follows naturally that minor processes, each with its own particular end, may serve as phases of the realization of a single principal aim, the aim of the lesson or the series of lessons. For example, in the appreciation of a selection of poetry, this principal aim of the appreciation may best be gained by the realization of several of the factors of method, such as the acquisition of the facts of the poet's life and of the setting of the poem, the appreciation of a word picture, and the drill in the memorizing of passages of special interest. These principal and subordinate aims correspond to what are, by the Herbartians, called the Ziele and the Zwischenziele (aims and intermediate aims). Naturally these terms are in a measure relative, since what may be a principal aim for a smaller lesson unit may at the same time be a subordinate aim in the realization of some still larger and more inclusive principal aim. However, in the practical work of teaching, the subject matter usually cleaves readily into sections, each of which possesses a distinctness of aim, content, and method such that it can be treated as a unit in teaching. Such a section of content, or teaching unit, need not coincide with the lesson of one class period. Not infrequently a topic will be so large as to occupy two or even more lesson hours, while on the other hand there may be more than one such unit dealt with in a single lesson. In the determination of the size and character of this teaching unit, both subject matter and teaching method must be considered. However, the usual condition and the one best adapted to instruction, especially in secondary education, is the coincidence of the topic or

teaching unit with the lesson for the hour, since the unity and perspective are thus better preserved and utilized.

4. The Five Modes of Instruction

Lesson Types.—Text-books on method often leave the pedagogical novice with the notion that there are certain sharply defined "types" or "kinds" of lessons which serve as moulds, in one of which every lesson must be cast and to which it must be made to conform. The truth which the teacher must early come to realize is that with differences of content and of aim come corresponding differences of method. He must further realize that the method in each case is not a mere haphazard, cut-and-try procedure, but a system of activities so selected and combined as best to realize the aim of the lesson. The number of possible lesson procedures as combinations of various forms or modes of teaching activity is unlimited. On the other hand, the number of these teaching modes, like the variety of muscular movements in our daily tasks, is decidedly limited. Moreover, efficiency in teaching, as elsewhere, is most readily secured when the number of component modes of activity is minimal for the realization of the end sought. Taking account of both subject matter and lesson aims, with the dominant factors of method involved, we find five such fairly well-defined modes or types of teaching, under which all the activities of the class exercise may be classed, and of which it is built up. Occasionally a single mode is dominant throughout the entire class exercise. More often several modes are employed in succession, and even overlap.

The Modes.—These five modes, which are to form the basis for the succeeding chapters, are the following:

1. The Recitation Mode.
2. The Problematic Mode.
3. The Appreciation Mode.
4. The Expression-Application Mode.
5. The Laboratory Mode.

Any one of the modes may of itself constitute an entire class exercise, though not always to advantage, the laboratory being the one most commonly employed in this way. Probably the arrangement most often used outside of the study of literature is that in which the first part of the hour is devoted to recitation, followed by and often combined with problematic development and closing with application. The appreciation mode is most frequently employed in literary study, in various combinations with one or more of the modes just named. In the application of these five modes of teaching the teacher must not look for ready-made formulas whereby the modes can be compounded in set arrangements and proportions, for the realization of certain definitely anticipated and classified aims. On the contrary, these are but the variously colored pigments which the artist-teacher is to select, blend, adapt, and apply for the carrying out of a design of which he himself must be the master. In the preparation of his colors he must know the laws of color mixture, and which components are the best to employ for the production of certain effects. His skill consists not in ignoring but in utilizing these laws and principles in the production of the finished work. In the study of the various modes of teaching the instructor must seek so to master them that the very fixity and definiteness of their qualities do not restrict him but serve him.

The Formal Steps.—The Herbartians have always laid great emphasis upon what are termed the "formal steps" of instruction. We are told that the teaching unit or "method whole" is inductive in character and leads us from particular observation and data to a general concept or concepts. In this procedure five well-defined steps must be followed, after the lesson aim has first been stated. Although differently named by different writers, there is no considerable disagreement as to their character, and the names suggested by Rein are the most commonly used, especially in the United States: viz., Preparation, Presentation, Comparison, Generalization,

and Application. As Rein[1] points out, these steps are applicable only when it is the purpose to develop a general concept, inductively. While it is true that induction does involve these elements, it is also true that as the American secondary school is taught, not all lessons are inductive, and that the "steps" are elements, often used simultaneously, rather than successive stages of thought. While the educational world is under untold obligation to the Herbartians for the systematization given to method of instruction by these "formal steps," we must be on our guard lest its systematic character become for us merely formal. In Professor Dewey's words[2]: "The more the teacher has reflected upon pupils' probable intellectual response to a topic from the various standpoints indicated by the five formal steps, the more he will be prepared to conduct the recitation in a flexible and free way, and yet not let the subject go to pieces and the pupils' attention drift in all directions; the less necessary will he find it, in order to preserve a semblance of intellectual order, to follow some one uniform scheme. He will be ready to take advantage of any sign of vital response that shows itself from any direction." On the other hand, we may often find the "steps" of real suggestive value in the organization of the lessons, especially those of an inductive character, the consideration of which will occupy us in a later chapter.

5. Summary

School education should secure for the student five qualities: knowledge of self, of environment, and of their mutual relation; power of thought; sympathetic feeling toward environment; power to express and apply; steadiness of character and permanence of attainments. Instruction which is adapted to the realization of this fivefold aim may be thought of as consisting of six elements or method factors: acquisition, as

[1] Rein, "Pädagogik in Systematischer Darstellung," II, p. 542.
[2] Dewey, "How We Think," p. 205.

the securing of information; reflection, as its interpretation; expression, as the giving out of received experiences; appreciation, as the feeling response to situations; drill, as the rendering permanent of experiences; and testing, as the insuring of results sought.

A conscious, definite aim facilitates instruction by giving the teacher a basis for selection of both content and method. For the student it renders the work significant and induces an attitude of co-operation and interest. In secondary education especially, the maturity of the students tends to secure identity of aim on the part of teacher and class. Such aim, with its subordinate aims, determines the processes of instruction as well as the size and content of the lesson.

In the realization of the lesson aim, instruction may be viewed under five modes, which are variously combined in the method of instruction for different lessons: viz., Recitation, Problematic, Appreciation, Expression-Application, and Laboratory.

QUESTIONS FOR DISCUSSION

1. Criticise the list of instruction aims suggested. Would you add self-reliance to the list? politeness? honesty?

2. Of the five instruction aims, which do you think is the most neglected? the most often emphasized?

3. What lesson aims would you suggest for lessons on the following topics: the battle of Waterloo? the proposition that the diagonals of a parallelogram bisect each other? the first declension in Latin? the making of a bookcase? the frosting of a cake?

SUPPLEMENTARY READINGS

Bagley, "The Educative Process," chap. III.
Henderson, "Textbook in the Principles of Education," chap. I.
Strayer, "Brief Course in the Teaching Process," chap. I.
Parker, "Methods of Teaching in High Schools," chap. V.
Suzzallo's article on "Types of Teaching," in Monroe's "Cyclopedia of Education."

CHAPTER IV

THE CLASS EXERCISE

1. Meaning

Forms of School Work.—The school work of the typical high school student is by no means wholly devoid of variety. Recitation and home study, laboratory, field excursion, and library study, each has its place in his schedule of work, and happy is that student who is able to recognize and realize that place in his educational progress. Indeed, if he fails in the attempt and does not see the relation of part to part and to the whole learning process, he can find not a few fellow unfortunates among his teachers who assign him these activities with but little better knowledge of their purpose. In thoroughly efficient and well-organized teaching, every form of student exercise has a definite function in the whole plan, each part having its direct bearing, well defined and clearly recognized, upon some other phase or phases of school work. Typical forms of student exercise in school instruction are the formal classroom exercise or "recitation," the field excursion, the laboratory exercise, the library study, and the student's individual lesson preparation, ranging all the way from the first-named highly social and teacher-controlled procedure to the distinctively individual and self-controlled home study.

The Class Exercise and the Recitation.—The better books on teaching deplore the use of the term "recitation" as commonly employed, since it naturally suggests a "reciting," phonograph-like, of material memorized by the student. The term is a survival of the days when the aim of education was conceived of as information, and the teacher's work consisted

in hearing lessons "recited." Unfortunately, the use of the term has, by force of suggestion, induced the untrained teacher to suppose that the work of teaching is, as the word implies, a hearing of "recitations," whereas the efforts of educators to-day is to lay more emphasis on thinking and doing, though the recitation element is not to be wholly eliminated. In order to negate this implication in the mind of the prospective teacher, we shall, in our study of the principles of instruction, employ the term "Class Exercise"[1] for the more common and formal type of class work which is conducted in the classroom, and reserve the name "recitation" for that form of activity to which it is strictly applicable. Leaving the other types of class work for a subsequent chapter, we will here devote the greater part of our attention to a consideration of the class exercise, its forms, aims, methods, and essentials.

Significance of the Class Exercise.—The educational work of the school centres about the class exercise. Because it is the chief point of application of the educational process it must take account of practically every phase of that process. Professor Dewey calls it "a social clearing-house where experiences and ideas are exchanged and subjected to criticism, where misconceptions are corrected, and new lines of thought and inquiry are set up."[2] It is there that the teacher undertakes most definitely and formally the direction of the student's thought, there the experience of the student is brought to consciousness and expression, and made to serve in the gaining of further experience. Not the least of the values of the class exercise is its social value. Every member of the class is called upon to contribute his share in the activity of the group, and in return receives his share in its benefit. Better perhaps than in the home circle he comes to appreciate

[1] The term "Class Conference," suggested by Professor Twiss, seems to us too narrow in its suggestion. *Cf.* Monroe, "Principles of Secondary Education," p. 460.

[2] Dewey, "School and Society," p. 65.

the significance of social helpfulness and to participate in its realization.

2. Personality in the Class Exercise

Individual and Social Aspects of the Class Exercise.—The old disposition to base educational method upon subject matter alone, combined with the newer demand for universal education, must be held largely responsible for the tendency to overlook the claim of personality and individual differences. "Mass teaching" and the "lock step in education" have become common objects of criticism among educational reformers, but the actual reformation is by no means accomplished. The "average student" is an imaginary, nonexistent being, and of the "typical student" we can speak with but little better aptness, for the number of "types" of student is limited only by the number of bases for classification. Nevertheless, social, economic, and intellectual considerations demand that young people shall be educated in groups rather than individually. Upon the teacher devolves the problem of determining just how individuality can be recognized and how group instruction can be employed without the two being reciprocally negative in action. Correct method is that which employs the group instruction as a means for the development of personality. For the accomplishment of this, the teacher must at the first opportunity study his pupils, and as the work advances watch the development of each member of his class, encouraging here and restraining there, appealing to one from one point of view, to another from a different one. The skilful teacher will be ever on the watch for individual capacities and traits which can, by proper treatment, be converted into trained talents, realizing that human progress is the result of the selection and development of individual variations. Nor may we neglect the shortcomings of those pupils whose cases demand special assistance and are often remediable. More frequent than

either are pupils who are neither superior nor inferior but simply "different," and whose cases call for specially adapted procedure. Method must never be interpreted as a cast-iron form into which student and study are to be forced and fitted. In the diversified curriculum of the high school some provision is made for individual variations of interest and capacity. In those studies in which the feeling element predominates this is especially true, since in response to emotional situations the greatest diversity occurs. Often, too, the appeal of a laboratory science has sufficed to hold a boy in school when all other agencies seemed futile.

Personality in Teaching.—In an earlier chapter (page 4) reference was made to the importance of the preservation of the personality on the part of the teacher, and the statement was made that this was dependent on his use of method. The teacher who falls into a routine of method, varying it but little, will soon cease to be a person (pedagogically speaking) and become a machine. Method and personality in teaching are not antagonists but allies, and the common foe of both is mechanism. One of the worst foes to the development of the teacher's personality is his tendency to depend upon the text-book for the organization and interpretation of the lesson, instead of formulating his own aim and organizing the available material accordingly. Personality must be preserved and exigencies in the class exercise must be met, but preservation of personality and meeting of exigencies really mean the making of even the unexpected serve toward the realization of the aim in view. But the preservation of personality and the obtrusion of individuality are not synonymous. To direct the newly fledged teacher, face to face with his first class, "Be natural!" would be a comedy were it not too often a tragedy, for he is confronting the most unnatural situation of his life. A characteristic of good teaching is that the individuality of the teacher is kept in the background, and anything that draws the attention of the student to the instructor is as a rule to be avoided. A frequent source of

distraction is the "schoolroom voice." Many a teacher whose conversational tones are smooth and musical assumes in teaching a harsh, high-pitched voice which is fatiguing to himself and nerve-wearing to his pupils. "Be yourself" is adequate advice only when interpreted as meaning "be your best self." Mannerisms of speech, of bearing, or of personal habit are usually distracting elements, and the teacher must study himself (better still, ask a competent friend to be a critic) in order to find out these unconscious obstacles to successful teaching. When we realize the force of imitation and suggestion, conscious or otherwise, in the relation of teacher to pupil, the importance of personality in teaching is yet more deeply impressed upon us.

3. The Atmosphere of the Class Exercise

Mood.—Attention has of late been directed by writers on school hygiene to the lighting, heating, and ventilation of the school building, and it seems a justifiable figure of speech to refer to the light, the warmth, and the movement in the intellectual atmosphere as well. By light we mean the spirit of cheerfulness which should prevail in all phases of school work. More influential than we ordinarily realize is the mood that prevails during the instruction, and, as this is true in learning, it is peculiarly true in appreciation work. The appeal of many a picture is enhanced or detracted from by its frame, and every schoolboy knows that he has found many a task the easier to do because of the spirit which prevailed in the doing of it. An army can march farther when it is singing and the band is playing; a class can learn better when in a cheerful mood. Not all students can be made to feel "It is good for us to be here," but it is possible to induce a considerable degree of good humor in work, and in the accomplishment of this there is no force as potent as contagion. At the beginning of a lesson hour, the class usually represents a variety of moods, but the absence of any dominant mood

and the attitude of expectancy are the teacher's opportunity. Accordingly, his mood can quickly and easily be made to pervade the class. Some one has said that the grouchy teacher should be quarantined, because he is suffering from a highly contagious disease. Why not express the thought positively by saying that the cheerful teacher is the illumination of the classroom, and of a sort of which there is no danger of excess? Carrying the figure further, this light not only radiates from the teacher but it reflects from the class, increasing in power with no fear of violating any law of the conservation of energy.

Spirit of Work.—Closely associated with illumination goes temperature. As in the new open-air schools, the pupils are warmed by vigorous physical exercise, so the warmth of the intellectual atmosphere of the classroom must be generated by the activity of the pupils and teacher. The adolescent loves to work, though he hates drudgery. Fanned by a real vital interest in the work of the hour, the spirit of the class can be raised to a veritable "glow." The teacher who comes into the classroom "on fire" with interest in his work and his message, not of explosive fireworks variety, but full of the zeal of a well-controlled but deep interest in his work and his students, will easily incite a similar response on the part of his class, and the intellectual warmth of the classroom will be assured.

4. The Classroom Activity

Importance of Activity.—The character ascribed to the class exercise earlier in the chapter is one that naturally implies activity, in which all members of the class have a part. The student has a part in the class exercise only as far as his activity extends. Receptivity alone is of practically no educational value. Only by *doing* can the student learn. However, this must not be interpreted as physical movement. Often the greatest intellectual activity is carried on silently

and without bodily action.[1] As a rule, however, the best type of activity is that in which mind and body both participate, each assisting the other in its task. The interest that attaches to work in which both mind and body are at work together upon the same problem is undoubtedly the strongest kind to which instruction can appeal. It follows that, as a rule, a greater degree of vitality in teaching results when the instructor stands at his work; a seated position usually tends toward a loss of vigor in instruction, and a consequent inactivity on the part of the class.

Use of Blackboard.—The usual arrangement of blackboard work in German schools is on the whole inferior to that in common use in America, in that it does not make as good provision for class activity. In the former case there is usually but a single blackboard, upon which one or possibly two students do all the blackboard work of the class at any one time. The American plan, whereby half or all of the students are working at the board simultaneously, provides for better distribution of the physical activity to accompany the mental. With us this factor of blackboard work performs a large function in the teaching of any subject wherein suitable simultaneous exercises are involved. Both students and teacher may to excellent advantage make more use of the blackboard for summaries, drawings, etc., than is usually done. While it is not uncommon for teachers to utilize the board in exposition, it is unfortunate that they so often feel handicapped by inability to draw. The ability on the part of both teacher and pupil to make drawings in class work is of inestimable value, and the ability to make *serviceable* ones, at least with a very little practice, is much more general than is commonly imagined, and should be encouraged and developed. The advantages of board work over seat work are two: it makes it possible for material to be observed and studied by the entire class, and it facilitates the supervision

[1] A suggestive illustration of this is given by De Garmo in his "Interest and Education," p. 204.

and assistance of several students working simultaneously. Its administrative difficulties and the limited practical value of blackboard skill outside of the school forbid its employment by students except for these two purposes.

Variety in Procedure.—Just as the newness of a country keeps the explorer alert and mentally active, so the element of variety and the unexpected serves a real purpose in rendering instruction interesting and lively. Not infrequently it is worth while to vary from the order of the text-book for the sole purpose of arousing the mood of expectancy, and thereby interest and attention. Adams[1] has called attention to the use of surprise as a thought stimulant in deepening the impression made by ideas which might otherwise be overlooked.

Distribution of Activity.—A point of technic which demands care on the part of the teacher is the distribution of the activity of the class. It is so much easier to do an intellectual task than to get it done by others that the teacher easily falls into the habit of doing the students' thinking for them. Moreover, not merely must the student be active but he must be the source of the activity. "One might as well say he has sold when no one has bought, as to say that he has taught when no one has learned. And in the educational transaction, the initiative lies with the learner even more than in commerce it lies with the buyer. If an individual can learn to think only in the sense of learning to employ more economically and effectively powers he already possesses, even more truly one can teach others to think only in the sense of appealing to and fostering powers already active in them."[2] Power of initiative is a product of this student activity, wherein the pupil is trained to feel the force of the problem, to recognize that it is a problem, and to realize that the power for its solution lies within himself. For the same reason, it is often better to call upon the class for a judgment as to the merit of a pupil's recitation or report than for the teacher himself to at once pronounce upon it, provided

[1] Adams, "Exposition and Illustration," pp. 214 *ff.*
[2] Dewey, "How We Think," pp. 29–30.

always that the spirit of the criticism be one of justice rather than of faultfinding. Thus initiative and self-reliance are among the aims, possibly are the chief aims, of the class exercise. The benefits of self-government in school administration are no greater than the corresponding benefits of initiative and self-reliance in thought.

Almost as bad as doing the student's work for him is a failure to secure a distribution of activity among the various members of the class. The ideal to be sought is equality of participation on the part of all the students, but the ideal is especially difficult to realize because of the great difference in ability as well as in temperament between the various pupils. Only by the most careful attention to the matter can the teacher attain even approximately to that ideal, but the importance of the result demands and justifies the effort. When the glow of interest is present and the movement is strong and rapid, only the greatest care will avail to prevent the slower or more indifferent pupils from being left out. Right here comes in the difficulty in determining the line where the spontaneity in response and distribution of activity shall mutually limit each other. Indeed, such a line cannot be fixed, but the teacher must determine it largely by experience, for the quick and the slow make a hard team to drive. The use of concert recitation carries with it the problem of distribution of activity, and with any but a small class it demands the most careful attention to make sure that all the students are really having a part. It is so easy for pupils to lag, even a fraction of a second, long enough for the brighter or better prepared student to speak the word, and they thus merely quote rather than recite. When the class is small and interest general, and the practice infrequent, it may serve the purpose of securing simultaneous activity for a number of students, but the inexperienced teacher should use it very sparingly.

Equality of participation is to be measured in terms not of time but of activity, and some pupils will participate more in twenty minutes of the class period than others will in

forty. Considerations of efficiency as well as fairness, therefore, argue against the retention of all the members of the class throughout the whole of every class exercise. There is no valid reason why the quick pupil who has already accomplished the result sought by the instruction should be required to wait as an impatient observer of his slower fellow students' efforts. Rather, he should be permitted quietly to occupy himself profitably with other work, either for the remainder of the hour or until in the course of the instruction his further participation is called for. While the leaving of the classroom during the hour is often inexpedient, the capable student can be trained to develop sufficient concentration of attention for independent study in his seat or at the rear of the room. Since the personnel of the quicker group is fairly definite and permanent, the seating arrangement of the class may provide for the location of this group at the rear or side of the room, where they can readily be disregarded in the instruction without change of seats.

Preparedness.—The bell announcing the close of the class period comes with disconcerting quickness to the young teacher in the midst of an interesting lesson. The plan he had hoped to carry through has experienced unexpected delays in realization. The unexpected is liable to happen with the best of instruction, but care on the teacher's part will often help to solve the problem by prevention of waste. Doubtless one of the greatest sources of delay is in the distractions that come into the class exercise. Possible difficulties must be anticipated and provided against. In science instruction, it is essential that the apparatus may be depended upon to work when it is wanted, with all adjustments made and materials at hand before the hour begins. Sources in literature and history, compasses and rulers in geometry, should be ready for use when needed. A two-minute interruption may cost five minutes of loss, owing to break in continuity in thought, and the activity of the class suffers accordingly.

Tempo. — Successful teaching must take account not merely of the What and the How but also the How Much, or more accurately the How Fast. The matter of the "tempo" in the class exercise is one which demands consideration, especially in American high schools, where the spirit of the school, like that of the nation, is one of hurry under pressure. There are times when the tempo of the class exercise should be comparatively high, in such work as drill and testing, and to a considerable degree in mathematics. In such studies as literature, where appreciation is the predominant factor, a rapid tempo would be destructive of the finer feelings which the lesson aims to arouse. Naturally, in material prepared for the day, especially where memory plays a prominent part, a more rapid tempo is usually called for. On the whole, the greater the degree of thought or feeling, the slower the tempo, while the process of application or drill calls for a more rapid movement, and an implication of this is that in general the tempo is slower in upper classes than in lower. As Professor Münch[1] has pointed out, the true aim is an inner tempo, determined in part by the character of the thought, in part by the personality of the pupils and teacher. Mere hurry does not mean a high tempo, but probably even the opposite. One of the chief tasks of the teacher, therefore, is to choose and regulate the pace with which the class exercise proceeds, holding in check the impetuous and prodding the laggard. It is here that setting a time limit upon work serves the double purpose of preventing dawdling and suggesting to the student a suitable tempo for intellectual activity.

5. Summary

The term "class exercise" is more suitable for the typical classroom instruction than the word "recitation," since it is more suggestive of thought and action rather than mere reciting.

[1] Münch, "Geist des Lehramts," pp. 408–409.

In the class exercise, provision must be made for the exercise and development of the personality of both pupil and teacher. However, distracting mannerisms and peculiarities must be avoided.

The best results are possible only when the mood of both teacher and class is cheerful, and the glow of enthusiasm pervades the work.

Provision must be made for the most general and well-distributed activity on the part of the class, with all distracting influences provided against, and with a tempo in harmony with the character of the instruction.

QUESTIONS FOR DISCUSSION

1. Some one has suggested the elimination of the formal class exercise, and the substitution of a kind of work-room plan, whereby each pupil studies independently and recites and receives instruction and advice as the progress of his study demands. What are the advantages and disadvantages of such a plan?

2. Some able persons refuse to enter the teaching profession because, they say, it destroys the personality of the teacher. How would you answer their claim?

3. Some parents prefer private tutors to public schools, claiming that the latter "level down" as well as "level up," and that they prevent the development of pupils' personality. Criticise their argument.

4. When before the class exercise the teacher finds himself suffering from a "grouch," should he dismiss his class? If not, what alternative is open to him?

5. Is it possible for pupils to experience the "glow" of interest when the instruction is really meaningless and gets nowhere?

6. When half of the class in geometry or Latin are working at the board, how may the remainder of the class be kept profitably active?

7. Are tempo and speed of progress coincident? Justify your answer.

SUPPLEMENTARY READING

De Garmo, "Interest and Education," chap. X.

CHAPTER V

THE QUESTION

1. Its Function

As employed by the teacher in the class exercise, the question may have a function quite different from that in the ordinary situations of life. Usually its purpose is the securing of information possessed by the person addressed but not by the questioner. The instructor, however, generally knows the answer to his question much more adequately than the student, and in such a case his aim is to bring to the student's mind a consciousness of an intellectual need. "Why should President Jackson's simplicity of manner of life occasion so much comment on the part of his contemporaries?" "Is there not a simpler and better method of factoring this expression than the method you have employed?" A question such as these leads the student to realize that the information involved or fact sought is not yet clearly mastered by him, but needs further reflection, observation, or memorizing. Its value, therefore, lies primarily in its stimulating effect upon the pupil, inciting him to more adequately master the situation confronting him, and perhaps suggesting to him a line of thought for doing so. In addition, it may serve the teacher as a means for testing the pupil's knowledge, as a basis for further instruction. "What did we decide yesterday was the cause of the meandering of rivers in level country?" The situation may not be one in which knowledge is the chief factor or even an important one. Rather one of the best uses of the question is to induce an emotional attitude, by thus calling attention to some phase of an appreciation-situation. "Why do you think the opening lines of 'Evangeline' so impressive?"

Moreover, grammatically it may not take the form of a question at all, though functioning as one. Many an excellent and typical question in the class exercise is followed not by an interrogation point but by a period. "If we increase the weight of the bob on this pendulum, we might perhaps expect it to affect the rate of vibration." As the term is thus used, it is obvious that the question plays a large part in the work of instruction, and its character and forms are more vital than the inexperienced teacher might at first suppose.

2. Kinds of Questions

Classifications.—The chief aim of the question, as we have seen, is to provoke mental activity on the part of the student, and occasionally to test his knowledge and attitude. For the accomplishing of these purposes, questions are of various types, each adapted in form to the particular type of thought or reaction which it seeks to secure. Professor Charters[1] recognizes but three kinds of questions in teaching—the information, the developing, and the test. De Garmo[2] suggests four types, the analytical, the developmental, the review, and the examination. We are indebted to Professor Stevens,[3] of Columbia University Teachers College, for a classification which with some modifications we shall follow in the present chapter.

The Memory Question is doubtless the simplest of the types, calling for merely a recital by the student of facts already stored in memory, and in the recital calling for but the lowest type and degree of thought. The memory demanded may be mere verbal or rote memory, which is but little better than mechanical; or it may be logical memory, in which the qualities of the thing remembered are, by association, made the basis for its retention. In either case the

[1] Charters, "Methods of Teaching," p. 300.
[2] De Garmo, "Interest and Education," p. 180.
[3] Stevens, unpublished lectures.

aim is almost solely informational. "In what year did the battle of Saratoga occur?" and "What was the occasion of Webster's second Bunker Hill oration?" are illustrations of memory questions.

The Analytic Question is, as the name implies, used in analyzing a unit of thought, showing its implications and its relation to other known facts. The analysis may serve the purpose of showing the instructor whether the student's concepts are correct and adequate, and thus offering opportunity for a needed reconstruction. For example: "What is the locus of all points in a plane equidistant from a point without the plane?" "Why do cyclones in the northern hemisphere have a counter-clockwise direction of rotation?"

The Development Question, while probably the most difficult to define, ranks high in value as a means of instruction. Its chief characteristic is its anticipatory character, for it aims to lead on the student from point to point, from the implied and related, and ever for the sake of attaining some goal of which the teacher is constantly conscious. A feature true in a measure of all types of question, but especially of the development question, is that it is seldom to be taken singly but as one of a series or sequence. The development process is necessarily a step-by-step procedure, employing often a considerable number of intermediate terms and thought movements in passing from the original thought material to the end sought. Accordingly, each question but serves the purpose of developing these steps, one after the other, under the guidance of the instructor. A series of questions whereby the teacher leads his pupils from the (known) method of multiplying a polynomial by a monomial to the (unknown) method of multiplying a polynomial by a polynomial would serve as an illustration from the field of mathematics. Another example, taken from physical geography, might be the procedure, by questioning, from the student's knowledge of the principles of erosion to the concept of the delta or estuary.

The Comparison-Contrast type of question is one in which two objects of thought are simultaneously studied in order that the characteristics of the one may serve to the better study of the other. The comparison question is of service in showing points of resemblance between the things studied, thus providing data for generalizations, whereas the contrast question has the peculiar function of accenting characteristic features of an object of thought by viewing it simultaneously with one or more other objects which, like it in many points, are conspicuously different in the point in question. It follows that the number of situations in which these questions can be used is somewhat limited. Things compared or contrasted must be markedly similar in vital points, with only one or, at most, very few features of strong difference. In all cases, the basis of comparison or contrast should be made clear in the question. Thus, to secure a generalization regarding the literary character of the romanticism of the nineteenth century, it might be of profit to compare the writings of Coleridge and Wordsworth, whereas a deeper impression of Wordsworth's tendency toward the mysterious in the interpretation of the common things of life is well secured by contrasting his writings with those of Coleridge, in which the opposite tendency prevails.

The Judgment Question is a type which is peculiarly appropriate in secondary instruction, since it demands a stage of mental development to which the high school student has attained to a far greater degree than the pupil in the grammar grades. The act of judging involves a weighing of values and a viewing of things in perspective. The personal factor plays a large part here, for the judgment question makes a direct appeal to the pupil's personal attitude toward things. By its means he may be led to see that the most important consideration in life is not knowledge but one's reaction to that knowledge. It thus furnishes one of the best means for the development of the ethical and æsthetic ideals, and thus forms the basis for the training of moral character and

of æsthetic appreciation. The following are examples of the judgment question. "Would it be better to solve this equation by comparison or by substitution?" "What do you think was Shakespeare's purpose in introducing the sleep-walking scene in 'Macbeth'?" "Was John Brown morally justified in his attempt to incite an uprising of the slaves?"

Pedagogic Relationship of the Types.—In our classification of questions according to the purpose which each is to serve, it is but natural that a single question should serve more than one purpose, and that the classes should accordingly overlap. A question whose immediate aim is analysis or comparison may at the same time serve as a member in a development series. The line of differentiation between comparison and judgment questions is obviously not a sharp one. To the thoughtful teacher, however, the recognition of the various aims in questioning may be of inestimable value in his use of this the most common instrument in classroom instruction.

Any positive statement regarding the relative value of the various types of questions would be hard to make. Naturally the memory question would rank lowest in the list, since it involves the least intellectual activity. The judgment question, on the other hand, demands a high level of thought, and is to a considerable degree a climax to the thinking of the other types. Accordingly it has a somewhat limited opportunity of application, though its great educative value justifies a far more extended use than it now receives. Of the other three, viz., the analytic, the development, and the comparison-contrast, the value is so great and the application so general that these three are probably the most serviceable and the most used in instruction.

3. The Essentials of Good Questioning

At the beginning of the present chapter we saw that the purpose of questioning is to make the student conscious of an

intellectual need, to lead him to feel the challenge of a problem, and to suggest the way in which to look for the solution. On the teacher's part, it serves the further purpose of testing the knowledge and the point of view of the student. It is obvious that questioning is good in proportion as it leads toward the realization of any or all of these aims, and the following suggestions may help the teacher in that direction.

1. **The Question Should, as a Rule, be Thought-Provoking.**—This does not mean that memory questions should never be asked, but that they should be decidedly in the minority, and that when introduced they should if possible be but leaders to thought questions. Close following of the text-book is necessarily detrimental to good questioning, since the student has no obligation to think out his answer, but is encouraged to rely upon the memory of what he learned in preparing his lesson. In much the same way, the adherence to arbitrary classifications, arrangement, or names suggested by the teacher himself is open to a similar criticism, since it encourages the substitution of formulas of words for the product of the student's own thought. If the teacher will rethink his subject matter, and in some measure at least reconstruct it, using new avenues of approach to the principles and new illustrations of them, and encourage his pupils to do the same, the thought factor will become much more prominent and beneficial, as well as interesting.

2. **The Question Must Be Clear.**—This is involved in the aim of questioning as such, in that thought can be provoked only in an attempt to meet a felt need, and a situation which has no definite problem or meaning can produce nothing worthier than bewilderment. The use of a question so framed or propounded that any of the student's attention is diverted from the answering of the question to the form of the question itself is not merely wasteful but disconcerting. It is essential that the teacher imagine himself in the pupil's place, and endeavor to see whether the question would then mean to him just what is intended by it. The question must

first be clear in language, using words and expressions the meaning of which is known to the student. Sentences should be so constructed that the antecedent of the pronoun will be unmistakable. A prime essential is that the teacher think clearly, since not a little of the obscurity of questions is but the reflection of obscurity of thought. However, most of the lack of clearness in questioning is doubtless due to incompleteness of statement, either as lack of words or as indefiniteness of expression. The teacher often fails to realize that much of the meaning of expressions is inferred from the context, and that the pupil's mental background is not the same as his own. As a rule, the form of question should be such that but one line of answering is open. "Compare the triangles *ABC* and *DEF*" is not definite, since the question does not specify the *basis* for comparison. Better, "Compare the triangles *ABC* and *DEF* as to area." The question, "What happens when sulphur and iron filings are heated in a test tube?" needs further qualification; *e. g.*, "Describe the chemical reaction that occurs when sulphur and iron filings are heated in a test tube." The direction, "Give a classification of rocks," may be obeyed by classifying them according to either color, structure, weight, chemical composition, or method of formation. "What did Charlemagne do when he became king?" may be correctly answered in any of a dozen ways. The mere fact that a poorly formulated question has elicited the desired answer is no vindication of the form of the question. On the contrary, its seeming effectiveness will tend to lead the pupil to believe that slovenliness in speech is no disgrace so long as it secures the desired result.

3. The Question Should Be Brief.—As a rule, a question is selective in that it specifies one particular feature of a situation and raises the problem regarding that feature, the other features being mentioned merely by way of specifying the situation. It follows, therefore, that the best question is one that touches merely the problematic element, with a

minimum of other data necessary for the definiteness of the problem itself. The following problem will serve as an illustration: "A certain freight train travels at the rate of twenty miles per hour westward from Boston. An express train, starting over the same route thirty minutes behind the freight train, travels at the rate of fifty miles per hour. How far from Boston will the express overtake the freight?" In this case all details of the situation are first specified except the one referred to in the last sentence. Here the brevity of the question is secured by the isolation of the problematic element to form the question, the situation having already been stated. The problem might have been stated thus: "If an express train, travelling westward from Boston at a rate of fifty miles per hour, is preceded by a freight train travelling twenty miles per hour, how far from Boston will the freight be overtaken by the express if it starts thirty minutes ahead of the express?" The superiority of the first statement is obvious, since the situation is put clearly to the student before its problematic factor is introduced, thus leaving the question direct and brief. Thus: "If at the battle of Saratoga Burgoyne had defeated the Americans, and after pushing his way to the southward had effected a junction with British naval forces sent up the Hudson, what would probably have been the effect upon the American cause, with the colonial territory thus cut in two?" A better statement would be the following: "Let us suppose that Burgoyne had been victorious at Saratoga; that he had pushed his way to the southward, and had effected a junction with British naval forces sent up the Hudson. Evidently the colonial territory would thereby be cut in two. What effect would this probably have had upon the American cause?" The oft-given advice, "Make your question brief," means to the teacher merely this: First state the situation fully and clearly. Then isolate the one problematic factor, and indicate it in a question as briefly as possible. Introduce but one problematic factor at a time, avoiding the use of double questions, such as "How

would you generate carbon monoxide in the laboratory and what precautions must be observed in the process?" "How do you account for the case of *homine* in this sentence, and why would not *viro* have been a better word to use?" The observance of the suggestions just made will assist the teacher in making questions both brief and clear at the same time, for brevity and clarity should be allies rather than antagonists.

4. **The Question Must Be Adapted to the Student.**—This includes adaptation to his age, interests, disposition, previous study, and experience. He should not be asked to form judgments when his experience is too narrow to provide the basis for the judgment. Reflection upon a topic which has no interest to him will necessarily be merely formal. A question that is so simple that the student feels annoyance at its pettiness or its very elementary character has no educational value. In other words, the question must be a real question for the person to whom it is addressed. Moreover, the state of mind of students varies widely at different times. Personal feeling, difficulty of content, or any of a dozen causes may occasion a condition of antagonism, overconfidence, indifference, or the like, which a well-chosen question will greatly help.

4. The Manner of Questioning

It is not enough to have good tools, but they must be well used. Good questions are most effectual only when the manner in which they are put is well chosen, and the inexperienced teacher may find the following suggestions of value.

1. Address questions to the class as a whole, give time for the answer to be formulated, and then call upon one to answer as spokesman for the class, insisting upon a ready answer. This means that every student will formulate an answer to each question that is asked, and will be ready and disposed to judge of the merit of the answer given by the student who

answers for the class. When we realize that the chief aim of the question is the stimulation of thought, it can readily be seen that where every student is thus actively answering every question, the activity of the class is fully distributed and the benefit of answering is gained by every student, even though the pupil called upon has the extra benefit of the expression of his thought. Even though this often involves a slower rate of questioning, the economy is great since each question benefits all instead of a few or possibly only one of the class. Indeed, the judgment constantly passed by the class upon the answer given, since based upon their own thought, is of no little value, and serves in a measure as a counter-criticism upon the answers they themselves had formulated though not expressed. It is evident that the practice of calling the name of the student before stating the question is as clear a violation of this principle as could be devised, although a mistake of which teachers are very often guilty.

2. From this naturally follows a second injunction. Distribute the questions, as far as possible, among all the members of the class. This must, of course, be in an order which seems to the class to be haphazard. Calling on students in alphabetical order, in the order of the seating, or in any arrangement whereby they can anticipate which one will be called upon next will, of course, result in the others assuming an attitude of unconcern, and much of the benefit of the work will be lost to them, if not to the one who answers the question.

In the distribution of questions in the class exercise, it is not sufficient nor is it always wise to address the same number or kind to each student. There should be an adaptation of question to student, and the variation between students is usually great. Since the greatest gain comes from activity in which the fullest power of the individual is exercised, it follows that the question put to the bright pupil should be of a different sort from that put to the dull student. This does

not mean that the bright pupil should have the hard question and the dull one the easy question, though this will not infrequently follow. It means rather that each question shall be so formulated that it will stimulate to his best thought that student to whom it is addressed. The case of the slow student is more puzzling. Slowness does not necessarily imply dulness, and if given time the slow student will often produce a fine piece of work. Practically all that can be suggested here is that he too exert serious effort and be constantly kept at his best speed. However, his "best speed" is never possible when he is hurried to the point of bewilderment, but must be determined empirically, in the course of the teacher's observation.

But other considerations besides the abilities of the students determine the distribution of the questions. The teacher must study each of his pupils and so far as possible adapt the questions to meet special needs. As one of the aims of questioning is the discovery of inaccuracy or inadequacy in the student's concept or memory image, the teacher should endeavor to place his question where it is probably most needed. The student who half knows his lesson can best be brought to a consciousness of his shortcomings by an unsuccessful attempt to answer questions about it. A natural implication of this is the wisdom of putting the question to the student who failed upon it before, possibly at the preceding class exercise, thus providing an added incentive for mastering the points in his lesson upon which he has shown himself to be deficient. Often, too, the bright and faithful student can, by a well-chosen question, be started on a train of thought which has a special appeal for his personal interests and ability, and which will provide him a thought problem for further consideration outside of class. The question thus serves as a thought stimulant and clarifier, and the careful teacher will place the question where it will be of most service. The device of addressing a question to a pupil who is inattentive at the moment it is stated is frequently of service

in compelling attention, especially if his consequent confusion be utilized to render inattention unprofitable. At the same time the teacher should employ the opportunity to find out the cause for the inattention, especially if the case is at all chronic. Inability to hear the teacher, disorder on the part of neighbors, failure to see the meaning of the lesson, lack of interest—any or all of these might be the cause of the inattention, and an understanding of the situation would assist in its solution. It must be remembered that inattention is but the symptom, not the disease, and the teacher who can adequately diagnose the case in its first stages has progressed far toward its cure.

Should a question be repeated if not understood the first time? Naturally it depends upon the cause of the failure to understand. If it be due to inattention, it is evident that a repetition of the question usually amounts to a toleration of inattention, and is seldom wise. If the cause be a lack of clearness in the question itself, it should be reconstructed. If the difficulty lay in the indistinctness of the teacher's enunciation, not merely should it be repeated with greater care, but it should suggest to the teacher the possibility that on other occasions also his spoken words may not be understood, though the difficulty had not been reported by the class. On the other hand, the failure to understand may be due merely to the thought character of the question itself, being properly formulated but requiring time for the realization of its significance as it is spoken. In such case, a deliberate repetition in its original form would usually be less confusing than its restatement in other words.

3. A third suggestion of the manner of questioning is that the teacher ask the question as though he himself is really interested in its answer. Mood is the most contagious thing in the schoolroom, and the teacher who is able to so throw his personality into his questions that his class will recognize his interest will have made an excellent beginning toward interesting instruction.

5. The Question as an Index of Efficiency in Teaching

In a monograph which bears the same title as this paragraph[1] a very suggestive effort is made to show that the character and quality of classroom instruction can with comparative accuracy be discovered by a study of the character of the questioning. Two points of observation are suggested: how many questions and how good questions. With the latter of these, the quality of the question, we have already dealt.

The number of questions is taken as a partial indicator of the distribution of activity between teacher and class. In the monograph the author, Professor Stevens, made a study of a number of typical class exercises observed in various high schools and found that the number of questions asked by the teacher ranged from about 40 to 175 or 200, during a forty-five-minute class hour, the average being between 75 and 100. Taking account of the pupils' answers as well, and basing the calculation upon the time occupied in questioning, it was discovered that the teacher used about two-thirds of the lesson hour with questioning, exposition, etc., and that the pupils occupied but half that amount. In other words, the teacher used twice as much time as his class did, and presumably did two-thirds of the work. Moreover, it showed that on an average the teacher asks and the class answers one question every thirty seconds. Such distribution and haste in teaching are practically destructive of thought and reflection on the part of the student. Naturally the number of questions and the distribution of time between teacher and class vary greatly according to conditions, such as the subject studied and the aim of the class exercise, but the teacher may well guard against too long-continued "rapid-fire" questioning, as well as against occupying an undue proportion of the lesson hour.

[1] Stevens, "The Question as an Index of Efficiency in Teaching."

6. The Answer

Essentials of the Good Answer.—As the purpose of the question was shown to be the stimulation of thought, the primary purpose of the answer is the expression of that thought, with its critique and suggested ideas. It has also as a secondary aim the disclosure to the teacher of the student's thought, and the offering of opportunity for the improvement of that thought and its expression. The good answer is one that serves these purposes.

In the first place, the answer must be adequate. It must, for the student at least, be "the truth, the whole truth, and nothing but the truth." The algebra student who, when asked to find the area of a field, closes his work with "$x = 36$, Ans.," has not adequately answered the question. He has merely brought his work to the point where the answer might be easily inferred, but left the inference itself for the instructor to draw. He has not told the "whole truth." When the pupil stated that in the flexion of the elbow-joint the biceps muscle grows smaller, he has given an inadequate answer. The pupil who was asked to decline a noun in the singular and declined it in both numbers, gave an inadequate answer. Both these two violated the principle "Nothing but the truth." When a student realizes that he will be held accountable for an exact and complete answer to the question, he will study the question carefully in order to catch the full significance of the problem.

A second requirement of the good answer is that it shall be matured. The teacher who accepts an answer which does not represent the student's best thought is encouraging careless thinking. In contrast to a common attitude among students that the answer is merely to satisfy the teacher, and that whatever thus satisfies is all that is called for, the student must be led to take his answer seriously. The teacher should develop the student's self-criticism, so that he will be

dissatisfied with any effort which does not represent him at his best. The pupil who replies before he has thought the problem through must be restrained until he is prepared to give a well-matured answer. This can often be done by showing him the absurdity or inconsistency of his hasty replies, and by holding him to strict account for all that he says. If, as should be the case, the answer is addressed to the class as a whole, the members of the class will add their disapproval to that of the teacher when one of their number seems to be careless in his words addressed to them. On the other hand, this personal responsibility for the answers to questions should not be permitted to lead to undue hesitancy in answering. The pupil whose reply to a question is itself a question or a guess with a rising inflection of the voice should not hope thereby to escape responsibility for its accuracy. The answer should be his own thought or belief, not that of the teacher, and if he is prompted in answering, the purpose of the question is thwarted. Not infrequently this prompting is merely a nod of the head, a change of facial expression, or even a gesture, of which the teacher is quite unconscious, and against which he must be constantly on his guard.

This suggestibility of students, especially the younger ones, may easily extend to their making statements quite contrary to their knowledge and judgment. Boys and girls, recognizing the superior knowledge of the teacher, will give assent to almost anything, if it seems to be what the teacher expects them to say. Such answering involves the suspension of their own judgment in the presence of a higher authority, which is thus accepted without challenge or thought concerning its implications. One of the values of the topical recitation is that this suggestion factor in questioning is eliminated.

The Topical Recitation.—As one of the chief purposes of the answer is the expression of thought, the topical recitation is of especial value because of the training it offers in thought

expression. When the class exercise takes the form of a mere series of questions, the task of organizing thought, which is one of the greatest benefits of educational training, is taken over by the teacher, to the great loss of the child. As a test of the evaluation and perspective in knowledge, of power to analyze thought, and of ability to express ideas in language, the topical recitation has a value immensely superior to that of brief one-sentence answers. Unfortunately, the development of power to give such an independent and connected recitation is usually difficult to secure. The teacher must first show the student how to select the important points of a topic, how to arrange them in logical order, and how to transform the ideas into well-chosen language. Often a discussion with the class in which these three steps are worked through in order will prove the best method of preparing the foundation for a subsequent topical recitation. The process may at first appear long and laborious, but the cost is small compared with the importance of training young people to discourse connectedly and creditably upon topics with which they are familiar. The efforts made by so many of our high school students when trying to speak in public upon even the simplest themes are at best disheartening, and the correction of the difficulty is as truly a task for the teacher of physics or of history as for the English department.

Adequacy of Expression.—The importance of adequate expression holds no less of the brief answer as well. The answer should be given in a form worthy of the thought which it represents. The carelessly worded, poorly articulated replies so common in the schoolroom are negative factors in education as far as training in oral expression is concerned. The bad habit on the part of teachers of repeating the students' answers, often correcting errors of speech, is a prolific source of carelessness in recitation, since the students soon come to feel that however badly they frame their answers or enunciate their words, the teacher will supply the deficiency in the amended repetition. If the student is made

to feel that he is addressing the class, not the teacher, and classes are trained to demand the student's serious efforts in addressing them, the occasion for repetition will soon disappear. Every answer must be a real statement of a thought rather than merely an abbreviated skeleton or intimation of that thought. While "yes or no answers" are not necessarily to be avoided, they should nearly always be followed up with a call for the grounds upon which the affirmation or negation rests. The demand that every answer shall be a complete grammatical sentence, while usually wise, may, however, be carried to the degree of pedantry. Forms of conversation which are proper in cultured society are proper in the schoolroom—these and no others. When student and teacher catch the spirit of culture in the conversation of the class exercise, problems of propriety in student answers will be appreciably fewer.

"As the teacher, so the school." As the question, so the answer. The progressive and conscientious teacher will see in the pupil's answer an index of the question asked. Poorly expressed answers raise the presumption that the questions were poorly expressed. Obscurity in answers suggests a corresponding fault in the questions. Fortunate the teacher who is able to use his class as a mirror for his own failures and successes.

7. The Pupil's Question

"Questioning by the teacher that does not lead to the asking of questions by pupils is unsatisfactory."[1] The best incentive to learning is the consciousness and challenge of a problem, and one of the best places for its suggestion and formulation, often of its solution, is the class exercise. The question asked by the pupil is one in which he has a real interest, and the teacher who instead of propounding a problem can induce the student to raise that problem, even though in a less logical form, has come near to realization of the aim

[1] Strayer, "Brief Course in the Teaching Process," p. 120.

in questioning; viz., the stimulation of thought. In the same way the teacher's reply to the question may well be itself a question, whereby he will suggest to the student not the answer but the direction in which it may be sought. In the solution the co-operation of the entire class should, so far as possible, be enlisted, thus making it a general rather than an individual problem. For data upon which to base the solution all sources should be employed as needed. Chief of these are the direct observation of the facts, the experience of the various members of the class, the text-book, and, as a last resort, the teacher himself. However, in his enthusiasm over the class problem, the teacher must not permit himself to be deceived by the ingenious lad who finds the asking of time-killing questions easier than the answering of relevant ones asked by the teacher. A definite consciousness of aim, a little study of the personality of his pupils, and a class sentiment in favor of seriousness of work will suffice to prevent serious dissipation of energy or "side-tracking" in the class exercise.

8. Summary

The functions of the question in instruction are the stimulation and the testing of mental activity.

Questions are of five types: memory, analytic, development, comparison-contrast, and judgment.

Questions should be thought-provoking, clear, brief, and adapted to the student.

They should be addressed to the class instead of to individuals, should be so distributed among students as to secure general response, and should manifest a real interest.

An excessive number of questions tends toward a wrong distribution of activity between teacher and class.

Answers should be adequate, well matured, and well expressed. The topical recitation is of value in the training of the student to organize and to express his ideas.

The pupil's question should show the teacher the needs of

his class, and should be made the starting-point for further learning.

QUESTIONS FOR DISCUSSION

1. What high school studies offer peculiar opportunity for the use of the memory question? the analytic question? the judgment question?

2. Criticise the following questions:

   (*a*) Why do we use mercury in thermometers?
   (*b*) What does our text-book give as the date for the assassination of Lincoln?
   (*c*) Which is the more important: political liberty or religious liberty? Why?

3. Recast the following question in a better form: If, after cutting a wide channel across the plain, a stream should, at flood season, cut across from one bend to the next, what would become of the lagoon thus formed when the stream subsided?

4. From the standpoint of questioning, what are the objections to classes of forty or more pupils?

5. Is it unwise to address a series of successive questions to a single student? Justify your answer.

6. How would you deal with the pupil who, though inattentive, is skilful in "bluffing" when he does not know what question was asked him?

7. Suggest ways in which students can be induced to ask questions in the class exercise.

SUPPLEMENTARY READINGS

Strayer, "Brief Course in the Teaching Process," chap. XI.
Keith, "Elementary Education," § 38.
De Garmo, "Interest and Education," chap. XIV.
Colvin, "An Introduction to High School Teaching," chap. XV.
Stevens, "The Question as an Index of Efficiency in Teaching."

CHAPTER VI

THE RECITATION MODE

1. Meaning of Recitation

In an earlier chapter our attention was called to the unfortunate use of the term "recitation" to designate any form of class exercise, laboratory work excepted, and the consequent influence toward making the class exercise degenerate into a mere "reciting" of acquired information. However, the inexperienced high school teacher, in endeavoring to escape this pedagogical error, often falls into the opposite one of lecturing to his class, doing the reciting vicariously for his pupils. Recitation on the part of the student is not necessarily bad. Like the other modes of teaching, it has its appropriate place and its proper manner, and within the limits of these it plays a necessary part which no other mode can fill. Discarding any thought of it as a mechanical repetition by the student of memorized facts or phrases, the recitation is taken as the rethinking in the class exercise of the experience of the student, acquired as a set exercise previously assigned by the teacher. In this, the class and teacher, as an environment for the rethinking, contribute to render the exercise more beneficial to the pupil who recites, and in no small degree to the pupil who listens and even to the instructor. The function of the recitation mode falls primarily under the two method factors of testing and drill, since these two are the ones that deal explicitly with material previously studied by the pupil. The recitation has also a forward look, since in the organic unity of a well-organized course every fact, every process, is anticipatory of a broader fact or process to follow it and extend its application.

2. The Recitation as Testing

Purpose.—The aim of the testing activity in the recitation mode is essentially that of insuring progress, for the teacher must assure himself that the class is really accomplishing the work undertaken. The testing accomplishes this purpose in five ways. In the first place, it determines the faithfulness of the student's preparation of the lesson assigned for the day. Some one has said that the ideal in education is that condition where every pupil in the class prepares his lessons just as well without as with the incentive of the teacher's authority. To this we reply that such students are not yet to be found in the schools, if indeed anywhere. We have yet to hear of the person, old or young, who does not find some measure of compulsion necessary in order to impel him to the maximum of his capacity. Most certainly the high school student with his limited perspective and his lack of training needs some compulsion in his work. In the testing of the recitation step, the opportunity for the exercise of this compulsion is provided. Secondly, it determines the adequacy of the student's preparation, thereby enabling the teacher to begin his instruction at the point where his pupils have left off. To attempt to lay the bricks of the superstructure before the foundation is fully completed is to "build in the air." To determine the character of that foundation and the consequent possibilities, limitations, and requirements of the superstructure is one of the first duties of the teacher. Thirdly, the testing enables the teacher to determine the adequacy of the instruction. Many a teacher flatters himself that his pupils have followed him in his exposition and development, whereas an inadequate or fallacious concept of the meaning of a term, a misinterpretation of a statement, an unusual background of personal experience, or even a wandering imagination may have resulted in the student's arriving at concepts and conclusions surprisingly different from those in-

tended by the teacher and even actually false. To discover to the teacher this situation so that he may vary his method of teaching to meet better the student's need is one of the chief functions of the testing activity. The fourth way in which progress is insured by the testing phase of the recitation is that it enables the teacher to test the appropriateness of the material being taught. Even the most experienced instructor often discovers that material which he has employed successfully for years is not adapted to the class before him, and the necessity for constant selection and adaptation is even greater for the inexperienced teacher. Other opportunities for observation offer themselves to the teacher, such as the laboratory and the responses of the student in the development of new work. However, the properly conducted recitation provides the best opportunity for the testing in a broad, thorough, and helpful way. Finally, the testing element in the recitation provides opportunity for explanation and correction. With the best of teachers and the most faithful of students, some things will be found obscure, some misunderstood. Attempts to proceed before these situations are met and the difficulties cleared up would be worse than useless, and it is peculiarly the recitation whose function it is to insure progress by insuring an adequate basis for progress.

Thus we have seen that the testing factor in the recitation has a fivefold purpose: insuring the faithfulness and the adequacy of the pupil's preparation, determining the adequacy of the instruction and the appropriateness of the content, and finally providing opportunity for explanation and correction. Good testing is that which best accomplishes these five purposes, either singly or, as is usually the case, several of them simultaneously.

Lesson Preparation.—Has the student prepared his lesson faithfully? If not, it may be a matter not of discipline alone, but of environment or method as well. In taking him to task the teacher must discover how much of the delinquency

is really the result of negligence and how much is due to conditions for which the student is only in part responsible. From the standpoint of the student's responsibility, a lesson may be considered faithfully prepared when he has either accomplished the task assigned or has conscientiously attempted to do so to the best of his ability, due account being taken of other obligations within or without the school, of other legitimate interests, intellectual or physical. The teacher who finds his class as a whole or an individual student habitually failing to give the lesson sufficient study may usually look for the cause in excessive or indefinite assignment, lack of interest, or conflicting duties or interests, and should endeavor to meet each cause with its appropriate remedy. This is the point where the domains of instruction and discipline meet, and the latter is often called into the immediate service of the former.

What shall the teacher do when he finds his class inadequately prepared? Every lesson plan presupposes a certain fairly definite degree of preparation and knowledge as its starting-point, and one of the most disconcerting situations for the inexperienced teacher is that in which he finds that the preparation of his students, their "apperceptive mass," is lacking and his first step checked. It is here that resourcefulness and adaptability, as well as the ability to foresee and prepare for possible contingencies, prove valuable assets. Before the teacher in the class exercise can proceed with the development and study of new material he must test his class by way of determining the adequacy of the foundation for his structure. For the purpose of the development of new material out of it, a lesson is adequately prepared when its fundamental principles involved are clear in the minds of the class, including a general notion of the implications of those principles. It may not mean that all of the details of the application have actually been carried out, for not infrequently it may take the new lesson to accomplish this. The second scene of the play may be taken up even though the

class has not yet completed the interpretation of certain details in the first scene as assigned for the day, provided the plan and movement of the first scene are sufficiently well understood to render the study of the second scene possible. The class is often able to attack the demonstration of a new problem in geometry, even though the applications and even certain points in the demonstration of the preceding problem need further study before being left. Of course, the teacher should not attempt it until assured that the basis for the new material is either already possessed or can readily be supplied as needed. Nor does it mean the abandonment of the unfinished work, but its completion alongside of the new, usually after more individual study out of class. The teacher must not in his haste to get on leave undone the work that is to be done. "I think you understand that well enough, and we must hurry on," is too often an excuse for slighting the work in order to cover a specified amount of ground during the school term.

But lesson preparation sufficient to render possible the development of new material does not necessarily mean that the lesson has been satisfactorily learned from all other points as well. Aside from its purely propædeutic function, when is a lesson learned? How shall we establish a standard whereby to judge whether an assigned task has been properly performed? Investigation[1] has shown a striking discrepancy in the grading of examination papers in high school subjects at the hands of different teachers of those subjects, thus indicating that standards of evaluation are far from absolute. The personal factor in the determination of adequacy of lesson preparation can never be wholly eliminated. It may seem tautology to say that a lesson is adequately prepared when the aim for which it was assigned has been realized. However, no more adequate standard can be established. The chief reason for the varying evaluations of a piece of work is the diversity of its aims, or even the indefi-

[1] Starch, "Educational Measurements," chap. II.

niteness of its aim in the instructor's mind. If the aim is memorizing, the lesson is learned when the pupil has it so well committed that he will retain it and be able to recall it when desired. If the aim is skill in the application of principles, lesson preparation means that the exercises assigned have made to that skill the contribution for which they were intended. If the aim is appreciation, the preparation of the lesson is adequate when the pupil has experienced the emotional response for which the lesson was designed. No more ultimate principle is possible than the one just suggested, and for lesson preparation the teacher should accept no less, demand no more, than its fulfilment.

Ideally, every student will adequately prepare his entire lesson every day. Practically even an approximation to this is by no means easy to secure, even for the experienced teacher, while to the beginner the problem of enforcing faithfulness in study on the part of the less industrious pupil is one of the most serious which he has to encounter. In the long run, the only solution to the problem is a combination of thought-provoking, interesting lesson-assignment with constant, patient insistence and watchfulness. Teaching the class how to attack their lessons, supervising their study, and rendering needed assistance and encouragement will often prove of unexpected benefit. A carefully planned written test during the first five minutes of the lesson hour, demanding brief and ready answers involving familiarity with the lesson, is a stimulant often resorted to by inexperienced teachers, with a degree of success. Like all stimulants, however, its effect is temporary, and it should be seldom used, and as soon as possible should be displaced by the more healthful incentive of duty and ultimately by that of interest.

Partly as a device for enforcing the preparation and still more in order that the teacher may know the needs of the class, it is a good practice to require that all students who for any reason have not fully prepared the lesson for the day report the fact before the beginning of the class exercise,

under penalty of severe reproof if the course of the hour discloses an unreported lack of preparation. This plan serves a threefold purpose. It provides an opportunity to excuse justifiable shortcomings, and saves the student the embarrassment of failures and perhaps unmerited reproof during the class exercise. It enables the teacher to know at the beginning of the hour just what to expect from every member of the class. It discourages the negligent pupil from hoping to escape detection of his neglect. The so-called "mathematical report cards"[1] whereupon the student reports at the beginning of each class as to the numbers of the problems solved, those unsuccessfully attempted, and those not tried, is one method of employing this general device.

The Oral Quiz.—Much more helpful than the written test is the oral quiz at the beginning of the hour. While it shares with the written test the task of enforcing preparation, it combines therewith four other equally vital functions. In the first place, it provides opportunity for directing the student's attention to secondary points and implications which otherwise would have escaped him, largely because his limited experience offers no point of contact between these and his already known world. In psychological terms, the connection between the new and the old is too remote for apperception to take place. After his study of "The Vision of Sir Launfal," he may need a little skilful questioning to lead him to see the significance of the "mouldy crust of coarse brown bread," and of the "water out of a wooden bowl."

A second function of the quiz, and one following naturally out of the first, is that of correction. The immature student, in the class exercise as well as in his home study or laboratory observation, will not only overlook things but will also misinterpret his experiences, and only a prompt correction will prevent further misconceptions as a consequence. The correction should not take the form of destructive fault-finding, and on the other hand it should not as a rule involve telling

[1] Mentioned by Young in "The Teaching of Mathematics," p. 133.

the student the correct observation or result. A truly constructive criticism is one wherein the student is led to discover for himself the inaccuracy of his answer and the correct method of procedure; then, unless the answer is unimportant and time lacking, to work out and substitute the correct conclusion in place of the erroneous one. When the student encounters excessive difficulty in correcting his mistake, appeal may well be made to the class for assistance, thereby not merely developing the spirit of helpfulness, but at the same time utilizing the problem as a class problem. Both in his own correction and in that by the class the teacher must maintain a rational distribution of emphasis, leading the pupils to distinguish between fundamental and trifling errors. Thus a pupil's mistake may often by skilful, considerate treatment be utilized for both intellectual and moral training of the class.

A third function of the quiz is that of leading the student to generalize upon the basis of the data acquired in his study. His laboratory observations may have given him the facts regarding each of a number of processes, his study of ballads may have familiarized him with the essential features of each, but the subsequent discussion of the principle in them all brings simultaneously to consciousness the common features of all the processes or ballads.

Fourthly, the oral quiz offers an opportunity to suggest applications of the generalization thus derived to the explanation of problems encountered outside the immediate field in which the generalization is made. A principle in physics may be made to explain a hitherto puzzling phenomenon in the action of a machine. Thus the oral quiz may combine with its fundamental factor of testing the further factors of reflection and application, and incidentally expression.

A further benefit results from the stimulating and broadening effect of classroom discussion. The various points of view and interpretations of different students induce a sort of funding of contributions, in which each individual contrib-

utes what he has and shares in the joint interpretation of the class.

The Examination.—A study of the testing factor in the recitation mode would not be complete without brief mention of its near relative, the examination. Indeed, it involves no stretch of the imagination to call the examination a reciting as a means of testing, and its problem is one of instruction rather than merely an administrative one. As the term is commonly understood, the examination differs from the recitation in two essential features. In the first place, it covers a much larger amount of material, and hence has much greater weight in the evaluation of the pupil's work. The examiner must therefore exercise care that the questions set shall be truly representative ones. Merely glancing over the work covered and selecting at random topics or problems which are easy to formulate as questions and definite to grade upon as answers obviously disregards this requirement. The truly representative examination is the one in which the questions are so distributed as most adequately to test the pupil's mastery of the subject in as many of its phases as the length of the examination will permit. Before formulating a question paper the examiner should have a definite idea of what the course is intended to effect, to what knowledge, power, or emotional development the student is supposed to have attained. With this in mind, a well-balanced, properly emphasized examination can be produced, in which fundamentals rather than incidentals are stressed, each in proportion to its importance, and the element of chance will be reduced to a minimum or perhaps wholly eliminated. A well-taught course and a representative examination will do much to reduce the anxiety of the student lest he get caught upon some unexpected or overlooked point.

The second distinguishing feature of the examination, in contrast to the recitation, is the fact that being usually in writing and coming at the close of a section of work, it offers practically no opportunity for discussion and correction.

For the student, the requirement of meeting the situation absolutely independently is by no means harmful but quite the reverse. However, the examination should when possible be followed by at least one class exercise or series of personal conferences for the clarifying of obscure points and the correcting of misconceptions. It thus ceases to be merely administrative in character and becomes a real instrumentality in instruction.

3. The Recitation as Drill

Function of Drill.—Whereas the testing mode is applicable to practically every type of educational content, drill is in its application limited to processes and memory material. We test the algebra student on his ability to reason out the statement of his problem, to formulate it as an equation, to solve the equation, and to state the rule for its solution. We drill him upon only the two last-named, representing respectively process and memory. Moreover, the less the process has been reduced to mechanism and the less mechanical is the type of memory involved, the less applicable is drill. Drill is, in fact, the rendering stereotyped and automatic of a process or memory which is so elemental in character that it can thereby be fitted to render permanent and ready service. The function of drill, therefore, is to secure readiness of process and retention of memory material, or, differently stated, it aims to render certain lines of action and thought habitual. It is thus a measure aimed at economy, since it largely frees the attention from the immediate details, for the consideration of other newer or less typical situations.[1]

Applicability of Drill.—Drill is, as we have said, limited in its range of application. In so far as emotion or reflection is essential in any content, to that degree is drill obviously unsuited, since it aims at automatism rather than thought, at

[1] As the reader will see, drill is here taken to mean something more than a mere unthinking, mechanical repetition of material.

products rather than processes. On the other hand, in such studies as the foreign languages, where the forms and relations are, for the student at least, largely arbitrary, memory plays a leading rôle. Mathematics involves many processes which are frequently utilized, and, although the student must thoroughly understand the basis for each step, he must be able to employ the process readily without pausing to rethink the logic of them. In the same way, such studies as manual training, the commercial branches, and physical training abound in processes and facts which demand drill for their establishment as memories. Drill is thus peculiarly applicable in the establishment of a rote memory, wherein there is a high degree of uniformity in the form of the material, and has but little place in the realm of logical memory, in which the form is subordinate and variable. It follows as a corollary of all this that, when the time and energy required by adequate drill upon a process or fact equal those involved in rethinking the process or rediscovering the fact when needed later, drill is a waste rather than an economy, and the wise instructor will be on his guard lest, in his zeal for thoroughness, he misdirect his efforts. As material illustrative of this might be cited some of the formulas in trigonometry and physics, the details of setting up the apparatus for the generation of certain less common gases in chemistry, and the method of solving algebraic equations by the substitution of $(u + v)$ for x and $(u - v)$ for y. The day is not long past when the study of history in the schools was mainly a memorizing of facts and dates, due largely to a mistaken conception of the function of historical study. To-day we realize that facts and dates to be memorized merely serve as the framework for the study of history, and, just because they *are* such framework, they form a comparatively small part of the whole, yet must be drilled upon until firmly fixed. In the study of mathematics the inexperienced teacher, rebelling against the mechanical memorizing of formal rules and "cases" of earlier days, is in danger of erring in the other

direction by not drilling enough upon essential processes. He often devotes his energies to a limited degree of drill upon a large number of data, whereas he might better drill more exhaustively upon a smaller number of fundamental points. The chief virtue in drill lies not in its range but in its thoroughness.

For convenience of treatment, we shall consider drill as of two forms or types, according to the form of its content, viz., drill upon processes and drill upon facts.

Drill upon Processes.—We have seen that one of the aims of drill is to render a process automatic, ready and certain in operation, and involving a transfer of attention from the process to the result sought. In other words, it is one type of habit-forming, and as such involves the principle of simple association.[1] What is really done in habit-forming is the establishing of a strong association between a certain type of situation and the desired type of response, so that the former inevitably leads to the latter. It follows that the rules for controlling association, as stated in Chapter II, are virtually those for the formation of habits.

For the instruction in the classroom the process may be viewed as consisting of two steps which might be termed the initiation and the fixation, and which correspond in general to Thorndike's "Law of Effect" and "Law of Exercise."[2] The former of these laws, which he calls "the fundamental law of learning and teaching," Thorndike states briefly as follows: "Satisfying results strengthen, and discomfort weakens, the bond between situation and response." In terms of classroom procedure, this would mean that a prime essential in drill is a strong motive. The first performance of the activity must be under the stress of a real motive. The student must feel the appeal of the situation as a real one *for him:* one the meaning of which furnishes him genuine gratification, and into the solution of which he injects his whole self. This insures what James calls "a strong and decided

[1] P. 17. [2] Thorndike, "Education," pp. 95–97.

initiative," so that the subsequent fixation of the activity as habit does not involve passing through an intermediate stage of drudgery, but the original interest persists until the habit is established. When the history student realizes that a knowledge of the sequence and dates of the United States presidential administrations will serve him as the framework for the location and relationship of the events in American history, the interest in the list will persist into and through its fixation in memory. Ideal habit formation involves a transfer of attention from process to product, but without this strong initial motive the attention is not thus transferred, but is dissipated during this intermediate stage of drudgery, and the product is the inflexible, inelastic habit of unintelligent mechanism. The boy who can solve the factoring problem only when he is told the case under which it falls is a typical product of unintelligent, uninterested drill. For him the situation to be met is not a mathematical one but one of avoiding unpleasant consequences.

The second stage in habit-forming, the fixation stage, is interpreted by Thorndike by the "law of exercise." "Other things being equal, exercise strengthens the bond between situation and response." Every performance of an activity tends to render that activity more ready and exact. Negatively stated, every exception permitted during the formation of a habit tends to weaken that habit. Drill, therefore, involves frequent repetition of the process for the purpose of fixing it. Account must be taken, not merely of the activity as such, but of it as a response to a certain type of situation. Accordingly, it must aim at a fixation both of the process itself and of the connection between the process and the problem to which it is the response. The drill upon the removal of parenthetical symbols in algebraic expressions must be permeated with the realization that it is not a juggling with symbols and letters, but the simplification of the expression for greater ease of its manipulation. The stages of initiation and fixation are thus seen, not to be discrete and independent,

but to form a definite unitary whole, the establishment of a ready, accurate, and lasting response to a typical situation. Drill upon processes is educative in so far as it effects the establishment of such a response.

Drill upon Facts.—The second type of drill, that upon facts, has a somewhat different psychical character. As the drill upon processes was essentially habit-forming, the drill upon facts might be termed memory-forming.[1] Here, too, we have a form of simple association, in that a memory is but an association set up between two ideas so that one leads immediately to the other. And here, as before, the rules for simple association are fundamental. A memory involves four distinct and essential processes: learning, retention, recall, and recognition.[2] All four are involved in drill though not all can be directly influenced by training. "There can be no improvement of the general or elementary faculty of memory; there can only be improvement of our memory for special systems of associated things; and this latter improvement is due to the way in which the things in question are woven into association with each other in the mind."[3] The implication of this oft-quoted statement of Professor James seems to be that the work of training a memory must be devoted less to the process of retention than to that of learning, an implication quite in accord with the teachings of present-day psychology.

The maxim, "Well begun is half done," has a peculiar validity in the case of memory, for that which is well learned stands an excellent chance of being remembered. On the other hand, retention is essentially passive, and as such can

[1] The word "memory" as here used refers not to a supposed general capacity for remembering, but to a particular type of mental functioning. For example, we have a memory of yesterday's rainstorm, a memory of the spelling of a certain word, etc. This employment of the term is in accord with its usage in modern psychological literature. *Cf.* Titchener, "Textbook in Psychology," § 117; Pillsbury, "Essentials of Psychology," chap. VIII, etc.

[2] Pillsbury, "Essentials of Psychology," p. 189.

[3] James, "Talks to Teachers," pp. 123–124.

be affected little if at all by specific training. For much the same reason, perhaps, retention is practically dependent as to both degree and character upon the learning. What was the best learned will be the best retained. What was learned in visual terms will remain predominantly visual, rather than auditory or motor, in its retention. The arrangement of elements in the learning will be their arrangement in retention. Recall is the active counterpart of retention. It is the "running down" of an idea which one believes to be at the remote end of a chain of ideas, the near end of which is suggested either directly or indirectly by the situation at hand. It is unnecessary to say that what has not been learned and retained cannot be recalled, yet teachers often overlook the corollary that what has been the best learned is the most readily and accurately recalled. The factor of recognition is seldom mentioned in pedagogical discussions of memory, yet its significance is real. To-day, as I sought to recall in a foreign language the equivalent for "thread," the word came to my consciousness. Though subsequent investigation showed the correctness of the recall, the element of recognition was lacking, and my memory of the word was really of little value because unreliable. The efficient student not merely will know, but will know that he knows.

Drill upon facts is, as we have seen, the formation of memories. The requirements for its successful conduct are therefore derived from the conditions of efficient memory and ultimately from the nature of memory itself. What must be the form and character of the content with which the drill is employed, and what the form and character of the drill itself?

Memory content must, in the first place, be deeply impressed. To this, a vividness of imagery is conducive, and the instructor will do well to utilize a variety of avenues of approach in "bringing home" a fact to be remembered. The student who has heard a chemical formula spoken, has seen it written, and has written it himself has received a far deeper impression than would have come from reading it from the book a dozen times. When the content is in the form of an

abstraction, it should be clearly formulated and its concrete application should be obvious. Clear ideas, like clear images, produce deep impressions, and abstractions without their concrete implications closely associated soon lose their implications and make but faint impressions upon consciousness because of their indefiniteness. A well-stated rule in algebra, Latin, or domestic science, supplemented with adequate training in its application, is infinitely better memory content than a rule which is obscure or poorly stated, or without its concrete implication in terms of actual problems in those subjects.

A second requirement of memory content is that its elements shall be widely and strongly associated. While depth of impression is fundamental in all memory, and is probably its dominant basis in childhood, the most effectual factor in the memory of adolescents and adults is the association of ideas. Since recall involves the tracing of an association back from an idea at hand to the one sought, it follows that in the effort to recall a desired idea the ability to hit upon an idea which has an association with the desired idea is essential. The teacher must therefore develop in the student's mind associations between the thing being studied and a number of other easily recalled ideas, so that the pupil may later be able to hit upon something which suggests the desired idea. The more roads lead to Rome, the more easily and surely one can find his way thither. However, we must make sure that the student *recognizes* the idea with which the thing sought is associated. A road to Rome is of little value to the traveller who does not know that it leads thither. Naturally the best method for this is to lead the student to such an interpretation of the idea that its relations with other ideas already familiar are recognized. In other words, its place in the system of the student's experience is the basis for the widest and best association. Such an association is the ideal, in breadth and in strength as well, and gives us the most serviceable type of memory.

The type of memory is determined by the type of its fun-

damental association. When the association is based upon purely arbitrary relationships, rote or mechanical memory is the result, whereas with an association whose basis lies in a connection in the character of the content, we have a logical memory. The fact that the date of Charlemagne's coronation at Rome was the year 800, that the length of the seconds pendulum is about one meter, or that the Latin word for advise is *moneo*, is in no way connected with the nature of Charlemagne's coronation, or of the pendulum, or of the idea of advice. On the other hand, the facts that Charlemagne's coronation was as head of the Holy Roman Empire, that there is a fixed relationship between pendulum length and vibration time, and that *moneo* is the basis of the English word "admonition," are not arbitrary but involve a logical connection. The former are matters of rote memory, the latter of logical memory. The difference between the two is fundamental and the appropriateness of drill in the two cases must differ accordingly.

Conditions of Drill.—We have seen that the content of the drill must be deeply impressed and widely and strongly associated. The character and form of the drill itself remain to be considered. The most obvious feature is repetition. Just as an act performed many times is the most easy to perform, so an idea longest retained and the most often brought to focus of consciousness is the most lasting in memory and the most ready of recall. Repetition is thus fundamental in drill, especially when the type of memory sought is rote rather than logical. Although a limited degree of repetition in the case of a logical memory assists in deepening the impression, extended repetition tends to reduce the thought relationship to a mere form of words, thus destroying its chief educational value. A demonstration in geometry, when memorized, ceases to be a demonstration, and has no more value than a list of nonsense syllables. In the case of rote memory, however, since the relationship is arbitrary and the thought involved is immediately obvious from the words memorized, the form of the content rather than its logical basis is the essential

feature and repetition is the leading element in the drill. The use of cases after certain prepositions, the formulas of many chemical compounds, and the lineal descent of the French kings are matters of rote memory, and can be memorized only by prolonged and frequent repetition. The same applies also to such processes as the use of instruments in drawing and sight-reading in music.

It is not enough that the matter be repeated many times, but the repetition must be rationally and economically conducted. Prolonged repetition naturally produces fatigue and consequently distraction of attention, which in turn prevents a deep impression. Economy in drill demands that the drill shall not be prolonged past the point where fatigue interferes with the focussing of attention upon the content. It is far better to drill often than to drill too long at one time. It has also been found that in some types of memorizing, and within certain limits, it is better not to divide the whole into small sections but to keep the larger units intact. For example, in learning a poem the student is advised to read the whole selection or large unit of content through from beginning to end a number of times, thus establishing the greatest possible number of associations between the parts in their proper order. This is better than first breaking up the selection into small parts and learning each part separately, thus setting up wrong associations between the end and the beginning of each part through the constant return from end to beginning in the repetition involved in the memorizing.[1] Since drill is for the purpose of insuring memory, these rules for memorizing apply with equal validity to the work of drill.

But mere repetition, however extended, will not suffice. Drill must be intelligent. The student who repeats mechan-

[1] *Cf.* Parker, "Methods of Teaching in High Schools," pp. 154–158. In practice the teacher will doubtless experience difficulty in introducing this method of learning. Since students do not see results as quickly as with the small-unit memorizing to which they are accustomed, they are likely to become discouraged and to attempt the learning with such lack of confidence as to hinder its accomplishment. In such cases, success is possible only through encouragement and patient insistence.

ically not only forgets quickly but fails to acquire readiness in the application of the thing learned. A formula of words whose meaning is not known is utterly useless. As we have already seen in the case of habit, so in the sphere of memory the aim is not to render the entire activity unconscious and mechanical, but the attention to the situation which stimulated the thought and to the purpose of the activity must never be permitted to flag. It is not enough that the student repeat mechanically the formula for the velocity of falling bodies or the conjugation of the verb "trouver." He must throughout the drill realize that he is giving the answer to the question, "How rapidly does a body fall?" or "How do the French say, 'I found, you found, they found'?" Probably one of the chief causes for the inability of students to apply what they are supposed to have learned in school is to be found in unintelligent, mechanical drill.

It is but another formulation of the same idea to say that drill must be applied. The concrete application of the material must be ever in the student's mind as he repeats the words in which the principle has been expressed. Not merely must rules and formulas be drilled upon in the abstract statement, but the student must be given corresponding practice in solving the problems to which they refer. The learning of lists of prepositions governing the dative will be of little practical service unless accompanied by drill upon the concrete cases: "aus der Stadt," "nach Hause," etc. The most effectual drill is that which most nearly approximates in form the actual situations for whose solution it is intended. Studying a vocabulary by always repeating first the foreign, then the English, word, will be of small service in learning to write Latin or speak French, as many a student has discovered to his sorrow. Not merely must the relation between the English expression and its foreign equivalent be remembered, but each must at once suggest the other in actual practice.

A further requirement of drill is that it shall be sufficient.

Although on his guard against prolonging the exercise to the point of fatigue, the teacher must also realize that the foundation-stone of habit-forming and memory-forming is thoroughness, for what is partially learned is soon forgotten. Mere knowledge that a fact is true, however clearly it may be understood, will not become a permanent possession until it has been deeply impressed by repetition while still fresh in consciousness. Thereafter, it is not necessary that subsequent drills be prolonged; indeed, often a single repetition will suffice to restore the freshness of an earlier memory. But what has once been won at the cost of much time and labor is presumably too precious to be permitted to slip away for want of precaution, and the teacher who believes in the conservation of acquired resources will so plan his work that the old will reappear, possibly in a new dress, but often enough to escape being forgotten. A restimulation of the memory by giving it a new and fresh motivation, especially in the light of newly encountered problems, will often assist greatly in reviving and deepening the original impression. The thoroughness of which our grandfathers boasted is a virtue which the modern teacher may well emulate. In these days of prescribed and overcrowded courses, the beginning teacher is ever tempted to press on to new themes, misled by a half-conscious feeling that what the student once knows he will retain. One of the hardest lessons for the pedagogical novice to learn is the importance and meaning of thoroughness. His task would often be greatly lightened could he but realize that thoroughness is rather intensive than extensive. It is not that everything be learned but that the fundamentals be mastered.

Cramming.—The question as to the value of cramming has often been raised and variously answered. Much depends upon the meaning given to the term. If by it is meant a final general review of what has previously been intelligently learned, with the purpose of refreshing old associations, its value is real and great. However, cramming is usually taken

to mean a hurried attempt to learn in a few hours what should have occupied weeks in the mastering. As thus interpreted, cramming is a violation of almost every principle we have just enunciated. Due largely to the haste of its method, impressions are not deeply made, since not sufficiently repeated. No opportunity is given for the formation of wide or strong associations. The material is learned only in the form of the abstract or general, since the concrete implications and applications are slighted. The real mastery of any educational content is a matter of time. Each step in thought, like each tier of stone in the building, must have had time to "find itself" before the next addition is made. With thorough teaching, hasty cramming will be not only unnecessary but impossible, since the review of what has been previously and adequately mastered will but revive associations, not construct them.

Summarizing what we have said in the present section, we see that success in drill demands two somewhat broad requirements. In the first place, it shall be intelligent. This involves that the student shall be conscious of a real problem, and shall realize that the content of the drill is the solution of that problem. Its implications shall be made obvious, thus facilitating recall by providing a variety of associations. Its concrete applications shall be so incorporated in the drill that the ability to use what he has learned is always insured. The second requirement is that the drill be adequate. The impression must be deepened by repetition not so extensive as to render it unintelligent but frequent enough to prevent the loss of the association through lack of exercise.

4. Propædeutic Function of the Recitation

Apperception in Teaching.—"Nine-tenths of teaching," says Professor Thorndike,[1] "illustrates the use or abuse of the law of apperception." While the recitation activity of the

[1] Thorndike, "Principles of Teaching," p. 43.

class exercise has its phases of testing and drill upon old material, it has also a forward reference. Learning is possible only when the new material is based upon past experience, and the Herbartian pedagogy lays great stress upon the importance of refreshing the old ideas before the new ideas to be associated with them are presented. "When it happens that the newly arrived stranger encounters no relatives in the consciousness, and that nothing can rise up from the circle of previous experiences to welcome it, it remains obscure and not understood, and a lifeless verbalism is the result. If, on the contrary, the new idea arouses a wealth of older ideas, crowding actively into consciousness, these latter become just so many forces to assist the new ideas to perfect clearness, strength, and assurance. They are, figuratively speaking, the welcoming arms with which the new arrival is embraced and adopted." [1] It is a matter of everyday experience that the character of the impression made upon us by a new idea depends to a great degree upon the ideas already prominent in our consciousness. The cry of "Fire!" conveys to the soldier on the battle line an implication very different from that suggested to the night watchman on the lookout for incendiaries, and each is the more ready to react adequately because his previous frame of mind was one of preparation for the event. The student will more readily learn to factor $x^4 - x^2 - 2x - 1$ when he has just before reviewed the factoring of $a^2 - b^2$. A recitation reviewing the movements of the opposing armies just before July 3, 1863, and the popular feeling in North and South at the time, will put the class in the best possible position to undertake the study of the battle of Gettysburg.

The Recitation as Apperception.—It is in this preparatory activity of the recitation mode that its propædeutic function is realized. In a well-planned course in any department of study there is always a unitariness and sequence, in accordance with which almost every lesson is a logical development

[1] Rein, "Pädagogik in Systematischer Darstellung," pp. 498–499.

from the preceding one. The oft-quoted principle that no material should be taught to the student until he feels the need of it might quite as well be expressed in the statement that each lesson or topic for study should, so far as possible, suggest and prepare for the next one. The recitation mode, coming as it does usually at the beginning of the lesson hour, is the most natural and logical preparation for the new material that is to follow. In secondary education especially it corresponds to the first of the five "formal steps," *i. e.*, to the preparation step of the Herbartian pedagogy.

The recitation mode, when thus utilized as a preparatory step, serves to revive old ideas and interests upon which the new lesson is to be based. A recitation upon the Persian wars and the ultimate victory of the Greeks would at the same time serve admirably as a preparation step for the study of the growth of the Athenian Empire and the Delian League, since the causes and significance of the latter can be understood only when the class have the former fresh in consciousness. Obviously the recitation need not be restricted to the material which the class have prepared specifically for the day, but should instead include a somewhat rapid review of all previously studied material which the new lesson is to presuppose and directly utilize. Thus opportunity is provided the teacher for the selection and emphasis of the material upon which the new lesson is to be based. He can make sure that the entire class have a common view-point and a complete, well-selected, and properly emphasized apperceptive mass. Without in any way detracting from the provision for individual differences, he leads all his pupils up to a recognition of the same situation, the same problem, and to a considerable degree the same data for the solution of the problem. With this accomplished, a common interest in the new lesson is practically assured.

Must every employment of the recitation mode have this propædeutic function? Is it not best occasionally to devote

an entire class exercise to recitation? If custom is an adequate justification, the latter question will certainly demand an affirmative answer, for the recitation mode is practically the only one employed by many who are considered fairly successful teachers. Such teaching, however, is at best drudgery when made more than an occasional practice, and the vitality which sometimes accompanies it is merely an accompaniment, not an inherent part of the instruction. It is the vitality of the teacher's personality, and exists not because of but in spite of the method. If the vitality is sufficient to survive in this artificial situation, what might it not be when the zest of discovery and progress pervades the class exercise! The recitation mode is the easiest to employ, and is naturally the one into which the lazy or non-progressive teacher is apt to fall. Moreover, being the simplest in character, it is the one most readily and commonly imitated. Is it too harsh to assert that a large part of our high school teachers, especially those whose professional training has shown them no better way, may be classed as either lazy, non-progressive, or imitative? If a study of method has any claim to virtue, it is that it enables the teacher to employ not one mode of instruction but many. It lifts him above the slavery of routine and renders him free and efficient in his educational activities. To the question with which the present paragraph opened, the answer seems to be that the recitation mode, as indeed any mode of instruction, may in rare cases occupy the entire class exercise, especially when it is made the occasion for extensive amplification and interpretation of the material recited upon. However, when the teacher finds such procedure becoming at all common, it will be well for both himself and his pupils if he blaze for himself new trails in the domain of method. The best results in teaching are attained not by the exclusive use of any one mode of instruction, but by various combinations of modes adapted to various pedagogical aims.

5. Summary

The recitation is more than a reciting of memorized material, but should serve the threefold function of testing, drill, and propædeutic.

As a testing exercise its aim is to insure progress by determining the student's faithfulness in study, the adequacy of his lesson preparation, the adequacy of the instruction, and the appropriateness of the material taught, and by providing opportunity for explanation and correction. Faithfulness of lesson preparation is not necessarily identical with preparation sufficient for further progress. The oral quiz serves to enforce lesson preparation, to amplify what has been studied, to correct errors, to provide for generalizations, and to offer opportunity for application. The examination differs from the recitation in that it covers a much wider scope and that class discussion is practically precluded.

Drill aims to render permanent and readily usable certain intellectual processes and knowledge which are sufficiently formal in character and general in application to permit of their automatic employment. Drill has accordingly a limited sphere of usefulness. Drill upon processes, as habit formation, involves the two steps of initiation and fixation. Drill upon facts, as memory formation, involves training in learning, retention, recall, and recognition, in so far as each of these is amenable to training. The content, in memory formation, must be deeply impressed and widely and strongly associated. Repetition is the fundamental process in drill, which must be intelligent, applied, and sufficient in degree.

The propædeutic function of the recitation mode lies in the fact that the review of any content may serve also as the preparation for instruction of further related content. This function is realized in a proper combination in the class exercise of the various modes of instruction.

QUESTIONS FOR DISCUSSION

1. Should the spirit of the testing in the recitation mode be that of trying to catch the delinquent? If not, what spirit should prevail instead?

2. When all the class show inadequate preparation of the lesson, how would you proceed to deal with the situation?

3. When a considerable number of the class repeatedly fail to prepare lessons, how would you deal with the situation?

4. What are the objections to beginning each class exercise with a brief written test on the lesson assigned for the day?

5. Some teachers require pupils to grade their own test papers. What are the advantages and the disadvantages of so doing?

6. A physics pupil was perfectly familiar with the formula, "Violet, indigo, blue, green, yellow, orange, red," but did not know to what the formula referred. What was wrong with his drill?

7. A history pupil could not recall the name "Magna Charta," but readily recognized it when prompted. What was wrong with his memorizing?

8. Would it be well to memorize the demonstration of a difficult proposition in geometry after it is thoroughly understood?

SUPPLEMENTARY READINGS

Thorndike, "Education," §§ 17, 25.
Strayer, "Brief Course in the Teaching Process," chaps. IV, X.
Parker, "Methods of Teaching in High Schools," chap. VIII.
Bagley, "Educative Process," chap. XXII.
Colvin, "An Introduction to High School Teaching," chaps. VIII, IX, X.
Thorndike, "Principles of Teaching," chap. IV.

CHAPTER VII

LESSON DEVELOPMENT

1. Learning and Feeling

Situation and Response.—The entire intellectual life of the child seems to consist in encountering situations and reacting to them. The teacher is constantly leading him to appropriate situations, and inciting and directing him to the best reactions. The entire curriculum is for the student a system of situations so selected and organized that the reaction to one serves as the introduction to the next. To the high school student the problem in mathematics, the Latin rule to be mastered, or the poem to be studied provides a situation demanding from him some suitable response. In the preceding chapter we treated the recitation mode as the reaction to a situation previously encountered, and recalled for further consideration. The treatment of a new situation, one which the student has not already encountered, calls for the employment of somewhat different modes of instruction.

The Meeting of Situations.—In dealing with a new situation, or, in the language of the school, in advance work, the procedure seems to fall into certain fairly well-defined elements or steps. Confronted with an electrical phenomenon in physics, the student first observes it to see what has happened, under what conditions, and what about it is not readily understood. Thus he becomes familiar with the problematic situation. Possibly it may not interest him further, in which case it ceases to be a problem to him and receives no further consideration. But if it is to be solved, it must appeal to his interest; it must challenge him with a demand for its solution. In response to that challenge or appeal, he proceeds to investigate for the explanation of the phenomenon,

the solution of the problem. Finally, he gives expression to the knowledge thus secured in the explanation or construction of some electrical device which occurs to him. A similar process occurs when he encounters a new proposition in geometry, an unfamiliar sentence structure in French, or a political movement in history. Or his response may be not merely intellectual but one of feeling, as in the case of the literary selection, to which he responds principally by appreciation. So we find that whenever the instruction is based upon the mastery of new situations there are involved for the student these four phases or steps: the knowledge of the situation, its appeal to him, his response to it, and the consequent expression. With any of these four elements lacking, the treatment of a lesson upon new material is incomplete and its value largely lost.

By knowledge of a situation is meant an acquaintance with its facts and conditions, so that the student encountering it has an adequate basis for its interpretation. But as knowledge alone will lead him to nothing unless it has an appeal to the student's interest, the situation must be such as to challenge his activity; he must feel it not merely as *a* problem or æsthetic situation but as *his* problem or situation. After the knowledge and the appeal of the situation follows directly the student's response to it. The response may be either an intellectual one, such as the discovery of a new fact or the solution of a thought-problem, or it may be a sentimental one, with appreciation as the dominant factor. Finally, the whole culminates in expression, whether of the fact or principle acquired or of the sentimental experience.

Types of Response.—The dominant factor in the response to the situation may be, as we have said, either intellectual or sentimental. One type of situation centres about the acquisition of desired information or the solution of a suggested problem. In the other the knowledge factor is merely incidental, serving as a means to the arousal of an attitude or feeling. We may thus characterize the two as

the learning type and the feeling type, yet not forgetting that they are merely types, and that no hard-and-fast line of distinction can be drawn between them. Thus, a description of the procedure in a presidential electoral college or an exercise in physics might illustrate the problematic type, the study of a literary selection the feeling or appreciation type.

2. Development in Teaching

Meaning of Development.—We have seen that learning and feeling are the student's activity in the face of a new situation, and that it is the teacher's function to induce and direct that activity. Moreover, the activity must be reciprocal, with both class and instructor in constant, intelligent co-operation. Teacher's questions must stimulate student's thought and counter-question. What is known must incite to further discovery, and recourse must be had to every suitable source of information, whether text-book, instructor, experiment, or past experience. Word picture must stimulate imagination, beauty of form must induce æsthetic response. Point must lead to point, and each moment must bring to consciousness a need for the next moment to supply. Here is evidently the place where the development type of questioning described in Chapter V will find its chief application. To this reciprocal activity, with the teacher as inspirer and guide, and directed toward the accomplishment of the learning and feeling processes, we shall give the name developing.

Whether the thing sought in the lesson be knowledge, or process, or feeling, the teaching consists in directing the thought of the class toward the accomplishment of the desired end, supplying data when needed, and even suggesting ideas which the class are qualified to appropriate and use but not to originate. Through this directing, supplying, and assisting activity of the teacher, and the reciprocal activity of the class, the lesson develops step by step from situation to

response, from goal set to goal attained, and it is to this joint activity that the name "lesson development" or "development instruction" is applied.[1]

A typical lesson development would be that of the demonstration of the geometrical proposition that the diagonals of a parallelogram bisect each other. In this case the teacher could, by a series of questions and occasional suggestions, conduct the class from the knowledge of the relationship of parallel lines and transversals, of equal angles, and of congruent triangles to the deduction of the equality of the segments of the diagonals. In like manner, deriving its data from the experience and suggestions of all its members, a class in science may through general discussion be led to an understanding of geysers, of the electric telegraph, or of the relation between a plant's leaf-and-stem structure and its demand for moisture. A lesson on the canning of berries might be developed by leading from a consideration of the cause of decay of fruits to a study of various preservative processes and materials, and their application to the fruit under consideration.

In lesson development it is not necessary that the class supply all the facts or even do all the thinking. On the contrary, the student must be trained to utilize all available sources of information, whether past experience or classroom experiment, the text-book or the teacher. Even in the thinking, the instructor must usually direct the train of thought, and even supply bits of the reasoning which the pupil is incapable of originating. The essential is that the student is intellectually active throughout, never merely recording but always thinking through, mastering, and making his own the new material, whether fact or process, argument or feeling. The source of material is but incidental. Whether a lesson is developed rather than merely recorded by the student is essentially a question of the student's activity.

[1] The reader will observe that the term "development" has here a wider connotation than is usually given it by writers on teaching method.

Thus it follows that such a topic as the battle of Gettysburg may be developed, by making use of map, of text-book, of the student's knowledge of preliminary conditions, and of the teacher's recital of facts. The development of Tennyson's "Break, Break, Break" is but a matter of so studying the poem with the class that they are led to an appreciation of it. In fact, simply reading a selection well, with an occasional comment and question, may at times constitute a development of it. The teaching of the use of normal, inverted, and transposed order in German will be a development provided the class are actively responsive in both thought and word in the explanation and interpretation of the principles involved.

Development involves a logical procedure from point to point, and a step-by-step advance from a given situation to its intellectual and emotional implications. Because of this orderly, systematic procedure with definite conscious aim, it involves much more than the term "conversation" would suggest.[1] It differs from the recitation mode in that it deals with a new situation instead of one already met. It differs from lecturing in that it involves the active participation of the student in the discovery and formulation of the material and its appreciation. It differs from study in that the teacher is constantly active in the arousal and guidance of the student's thought. In other words, whenever both teacher and class are reciprocally active in the learning and feeling processes of the class exercise, the procedure is called development. Thus, as the term is here employed, development is more than *a* method. It is *the* method of teaching new material, if we have justified our position that only reciprocal activity in the class exercise constitutes teaching. If lecturing can be classed as teaching, as is the case with advanced pupils, it

[1] Parker suggests the substitution of the term "conversational method" for "development method." His warning against wandering and poorly distributed activity in the use of the "conversational method" would have less force were he to adhere to the term "development" as above employed. *Cf.* Parker, "Methods of Teaching in High Schools," pp. 437–438, 441.

is only when there is a constant active intellectual response on the part of the class, even though unexpressed.

Value of Lesson Development.—The great pedagogical merit of development as a form of instruction is generally recognized, especially in Germany, where the thorough training of teachers facilitates its employment. The German school recognizes the function of the class exercise as an occasion not for recitation merely but for learning as well. For example, the Prussian school regulations specify that the first essays by the students shall be written in the class exercise rather than as an outside assignment. In practice, however, the employment of development in instruction is neither common nor easy. We are prone to subordinate power to information, and to neglect the development because the information can be imparted so much more quickly by telling or reading. Moreover, lecturing and recitation are easy in comparison, and as a result a large part of high school instruction is in the form of these. Development demands the exercise of all the qualities of leadership, including a readiness in the interpretation of the child mind, a strong power of suggestion, a thorough knowledge of perspective, and the capacity to adapt and utilize the unexpected in the realization of a desired plan. However, despite its difficulty of acquisition and employment, the lesson development more than repays the effort required.

Possibly the most common objection raised to development instruction is that it does for the student what he should be trained to do for himself, in his study. This objection arises from a misconception of the character of development. Doing a pupil's thinking and learning for him is not development. On the contrary, developing a lesson involves doing for the student what he cannot do for himself, doing it at the moment he needs it, and insuring its mastery before further progress. Instruction by a good teacher is far superior to self-teaching out of a text-book because of its adaptation to the movement of thought and the individual needs of pupils.

The text-book is at its best only when it supplements the teacher, not supplants him. Many a text-book in the market to-day is far better adapted for use in a correspondence course than in school instruction, and owes its popularity to the fact that it undertakes to relieve the poor teacher of the most exacting part of his work.

3. General Principles of Development Instruction

However widely the modes of development instruction may differ in many respects, there are certain respects in which they are fundamentally similar. In every case there is a measure of acquisition, of reflection, and of expression, whether the factor of appreciation be included or not, and we can discover a number of general principles which, with varying degrees of applicability, hold in all developmental procedure, whether of the problematic or of the appreciation mode. Although variously stated and interpreted, there is a marked degree of agreement regarding the principles, some of which have come down to us from the seventeenth century with but little change of form.

Known to Unknown.—Proceed from the known to the unknown. Thought occupies itself only with that which interests it, and interest is possible only with that which bears some relation to what is already familiar. This is practically a restatement of the principle of apperception. As the child apperceives the new in terms of the old, so the high school student interprets the new situation through the medium of his past experiences, and the new situation becomes a situation *for him* only in so far as it is seen to arise out of existing interests. Thus both the student's acquaintance with the new situation and his response to it are dependent upon the procedure from the known to the unknown. In geography we begin with the school grounds and the home town, and gradually extend the field of study to ever more and more remote lands. In Latin the student's famil-

iarity with the first conjugation is made the basis for his study of the second conjugation. The multiplication by polynomials in algebra is made more clear when its relation to the multiplication by monomials and its analogy to arithmetical multiplication are first shown. Whittier's "Snowbound" would have little meaning to the schoolboy who was not able to construct the background out of his own experience. In any field of study the teacher who at the opening of the class exercise plunges directly into material unfamiliar to his class will soon discover that his pupils are not with him, and that he is travelling alone.

To say that instruction must take its beginnings in the familiar implies that the teacher shall know what is the familiar. He must know the "apperceptive mass" of those whom he would instruct. One of the most common as well as serious mistakes of the beginning teacher is that of overestimating the knowledge and experience of his students. Facts and judgments which are familiar to him and are mistaken by him for the acquisitions of his childhood may represent the gradual and unconscious acquisition of his college life and be quite unknown to the high school boy and girl. The teacher must be able to put himself in the place of the student, seeing things through the latter's eyes, and interpreting them in terms of his adolescent experience.

Analogy.—It is probably no violation of logic to view the use of analogy as a phase of procedure from known to unknown. In teaching by analogy the relation of the unknown to the known, the new to the old, is not a matter of degree of complexity, as is so often the case where the known is the simpler and the unknown is such because of its greater complexity. The relation in analogy is rather one based upon similarity, so that, in place of a connection based upon content, analogy is founded mainly upon the form of thought. There is a close parallelism between the relationship of elements in the two analogous cases, such that the student's understanding of the relationship in the one case can be

utilized in leading him to understand the other. In teaching the student to multiply $a + b + c$ by $a + c$ the teacher will naturally base his instruction upon two known processes, the multiplication of $a + b + c$ by a and c separately, and an arithmetical multiplication such as 12×431. In the former process the relation of the known to the unknown lies not in analogy but in the nature of the content, viewing the latter as an extension of the principle of the former. In the analogy with the arithmetical operation, the relation is in the similarity of treatment in the two somewhat dissimilar problems. True analogy is rarely or never coincidental, but is usually based upon a real connection between the two analogous elements. In the illustration just cited this fundamental connection between the arithmetical and the algebraic processes is readily noticed by the student. In general, the more fundamental is the connection the better is the analogy and the greater its educational service.

As illustrations of the use of analogy in teaching might be mentioned the following much-used explanations: the electric current as water flowing through a pipe, the nervous system as a telephone system, the advance of the frontier as the overflow of a rising lake penetrating the surrounding country by following the lines of least resistance, and the spread of a political or social propaganda as the action of yeast in a mass of dough.

Analogy is a most effectual tool in the hands of the careful instructor. It is, however, a tool which when carelessly used may cause serious mischief. The fact that the relationship is mainly one of similarity leaves room for the student either to assume too great a degree of similarity or to select the wrong elements as similar, overlooking the ones intended. In the mathematical analogy just suggested the beginning student might infer that *ac* should be placed under *ab* in the partial products, since the product of 2×4 is placed under that of 1×3. The use of the analogy in explaining the doctrine of States' rights by the pupil's right of withdrawal at

will from membership in a debating society may lead the student to a fallacious conception of the Union unless the points wherein the analogy holds are clearly indicated. Thus the employment of analogy must always involve a clear understanding of the basis and scope of the parallelism which forms its foundation

Simple to Complex—"Proceed from the simple to the complex." This maxim would be less subject to criticism if it read: "Proceed from that which is simple for the student to that which is complex for him." As thus interpreted, the maxim is true, for the child mind naturally tends to understand and appropriate the simple before the complex. This is especially true where the relationships studied are logical, as in mathematics, rather than arbitrary, as in some problems in botany. Obviously, it is wiser, if not necessary, to lead from multiplication by monomials to that by polynomials; that is, from the simpler to the more complex processes, rather than in the reverse direction. The working of the electric motor would be unintelligible unless the principle of the electric magnet had first been understood. On the other hand, that which is logically simple may be pedagogically complex, and the logically complex may for the child mind be relatively simple. The human body is infinitely more complex than the amœba, yet the schoolboy studies it first because it is within the realm of his present experience and as such actually the simpler of the two for purposes of study. The logically simple may not as such be immediately a matter of experience at all, but rather the product of the analysis of an experience which the student has encountered many a time, yet has never analyzed into its elements. As such might be mentioned the conjugation of the verb in English grammar, the function of seed production as the preservation of the species, or the apparent smallness of remote objects as the result of the smaller retinal image.

Concrete to Abstract.—"Proceed from the concrete to the abstract" is a maxim based upon a truth, although itself

only a half-truth. It is true that each abstraction is derived originally from concrete experience, but it is equally true that every concrete act of thought returns again to the concrete. True learning springs only from definite, particular problems or situations arising in the student's experience. When the same situation recurs he generalizes regarding it, and applies his generalization to the solution of similar situations as they are encountered later. Thus, we should let our maxim read: "Proceed from the concrete through the abstract, and then back again to the concrete." Neglect of the first part of the maxim is no more and no less an error in teaching than neglect of the second part. "Beginning with definitions, rules, general principles, classifications, and the like, is a common form of the first error. This method has been such a uniform object of attack on the part of all educational reformers that it is not necessary to dwell upon it further than to note that the mistake is, logically, due to the attempt to introduce deductive considerations without first making acquaintance with the particular facts that create a need for the generalizing rational devices. . . . The isolation of deduction is seen, at the other end, wherever there is failure to clinch and test results of the general reasoning processes by application to new concrete cases. The final point of the deductive devices lies in their use in assimilating and comprehending individual cases. No one understands a general principle fully—no matter how adequately he can demonstrate it, to say nothing of repeating it—till he can employ it in the mastery of new situations, which, if they *are* new, differ in manifestation from the cases used in reaching the generalization." [1]

Thus, in teaching the law of the pendulum, we should first experiment with a pendulum, then generalize regarding its performance, and finally test and apply that generalization with other pendulums. The rules for the use of the subjunctive in "*ut* clauses" must first be derived from concrete

[1] Dewey, "How We Think," pp. 98–99.

instances of its use, and must be followed by the observation of concrete instances of the rule's application. The principles of the relation of supply and demand in economics must arise from actual concrete situations, and must later be applied in the interpretation of further concrete situations.

In the procedure from the concrete through the abstract to the concrete, we have virtually a procedure from the known to the unknown. The concrete situation which gives rise to the thought is in the main a familiar one. It is only when we experience an incompleteness, an element of the unknown in the otherwise familiar situation, that we go in quest of knowledge. When that newly acquired knowledge has validity not merely for the situation whence we started but for others as well, it becomes a generalization, and we at once apply it to the other newer situations as a means for their solution. Thus it is as impossible to begin with the abstract and proceed to the concrete as to begin with the new and proceed to the familiar, since the former type of procedure would but coincide with the latter.

Illustration.—The use of illustration in teaching is closely related to the problem of concreteness in instruction. Although the term is variously and often inaccurately employed, its legitimate use is limited to that concrete material which is employed in formulating the abstraction and showing its implication. The concrete which follows the completed abstraction is properly application, not illustration, and its special consideration is reserved for a later chapter. Illustration, on the other hand, refers to all of the concrete situations from which the abstraction is drawn. It includes all the instances cited, by teacher or class, for the purpose of facilitating the abstraction. This might easily be taken to include the original situation out of which the entire thought process arises, since the nature and function of this initial situation is merely an instance, usually an especially typical and suggestive one, of the principle involved in the abstraction. In studying the phenomena of stream erosion, the par-

ticular instances which are observed in the discovery of principles deduced serve as the illustrations; whereas the further cases, for whose explanation the principles are employed (such as the delta of the Mississippi and the formation of oxbows), are the applications. Thus, the function of the illustration is to assist in leading up to the generalization of the lesson, and is ultimately inductive in character. At the same time there is usually a constant interplay between abstract and concrete, and the illustration which anticipates the principal generalization may serve also as a concrete application of a principle which immediately preceded it. The concrete cases which served as applications of the principle of stream erosion may at the same time serve as illustrations from which to deduce the principle of the general levelling action of water. Thus illustration is not necessarily inductive alone nor deductive alone, but often both at once, account being taken of the direction in which it is made to point.

"Begin your exposition with an illustration" is a word of advice often heard. Otherwise stated, it means that the development of the lesson can best be carried out when it originates in a concrete situation. Even though the thought process involved is to be deductive, only a concrete problem or situation will serve to stimulate the student's mental activity, since only such appeals to him as real and significant. The first words of a lesson, like those of a lecture, often determine to a great degree the attitude of the hearer, and a well-chosen, aptly put, illustration of the central thought of the lesson hour will work wonders in creating a favorable intellectual atmosphere for learning.

Just as the illustration at the beginning of the lesson development assists in focussing the thought of the class upon the situation or problem to be considered, so its use during the development serves to clarify that situation, and leads the student to realize its concrete implications as its various phases present themselves in the course of the class exercise. In other words, the function of the illustration is to provide

the concrete data out of which the final generalization is to be derived. To attempt to teach without illustrating is to attempt to abstract with nothing from which to abstract. It is merely formal and devoid of content. The abstraction is but the skeleton; the illustration is the flesh and blood. Indeed, there is a suggestion of truth, though a measure of error, in the old saying that it matters little how one generalizes so long as his illustrations are good.

Requirements of Illustration.—What are the essentials of a good illustration? As its function is the supplying of data as the basis for generalizing, obviously the best illustration is that which best fulfils that function. With this in mind four requirements might be suggested.

In the first place, the illustration must be familiar to the student. Citing the desert lizard as an example of protective coloring has little significance for the New York schoolboy. Not merely is the familiar more interesting to him, but it alone has meaning for him, since it represents his own experience. To the justice of this requirement all will give intellectual assent. Possibly all that is necessary, therefore, is to recall what was said earlier in the chapter, where the teacher was urged to proceed from the known to the unknown, since the principle involved and the importance of its application are the same in both cases.

Secondly, the illustration shall be accurate. It must represent the principle correctly, and must not be something which, however suggestive or interesting in itself, is likely to lead the student to an erroneous conclusion. Illustrating the wave motion of sound by means of transverse waves on a loosely stretched rope is very apt to lead the student to think of sound waves as transverse instead of longitudinal. To find accurate and suitable illustrations is not always easy, but when unsatisfactory ones must be employed the teacher should use the greatest care that the inaccuracy is not permitted to suggest false implications to the student. Schematic drawings, idealized pictures, and simplified or enlarged

models serve a real purpose in instruction, but the student must be made to appreciate them as such. What is to the teacher obviously schematic, idealized, or simplified may by the inexperienced and uncritical student be taken for an approximately accurate representation.

Thirdly, the illustration should be as simple as is consistent with accuracy and adequacy. If it is well chosen and presented, the vital point to be illustrated will stand out prominently and clearly, with no occasion for the unessential and incidental being mistaken for the fundamental. Many an illustration otherwise excellent is unsuitable for the high school student because of its complexity, leading to confusion rather than clarifying of thought. Better one or two helpful illustrations well understood than a wealth of confusing ones. Moreover, an illustration may be so striking or interesting in itself as to distract the student's interest from the thing to be illustrated to the illustration itself. How often the schoolboy, when told to observe the circulation of the blood under the microscope, is so attracted by the shining brass and curious mechanism of the instrument that he fails to see the blood circulation at all. He looks not through the microscope but at it.

One phase of the problem of the simplicity of illustration is the function and merit of specimens, illustrative apparatus and models, pictures, diagrams, and maps, when used as illustrative material. It is clear that all five serve to strengthen the imagery and hence to deepen the impression made. However, apart from the degree to which they serve this purpose, these five types of illustration differ essentially as regards the conditions to which they are adapted. For the purpose of acquainting the student with an object in its entirety, its general appearance, or character, the specimen or, if this is not available, the picture is the natural type of illustration. On the other hand, the diagram, including the map as one of its special forms, is used to show in isolation a particular relationship between the parts of an object or sys-

tem. The apparatus partakes somewhat of the nature of both specimen and diagram, since it is designed to combine the objectivity of the former with the isolation of specific features which characterizes the latter. Thus the requirement of simplicity of illustration has various applications, according to the aim to be realized. In general it may be said that the picture (including the word-picture) may offer so many details as to distract the student's attention. Paradoxical though the statement may seem, a picture may offer to the student more of detail than the specimen itself, since the inclusion of details in the picture implies their importance, whereas when confronted by the specimen the student recognizes the necessity of distinguishing for himself between the essential and the incidental. On the other hand, when first encountering an object or problem for study, especially if a somewhat complex one, it is usually best to illustrate first by diagram the relationship to be observed, and later to study the specimen itself as soon as the student is ready to interpret what he sees. Generally speaking, that diagram or map is best which shows only the essentials of the relationship to be illustrated, that apparatus is best which shows the process or object with the fewest distracting features, and that picture or specimen is best in which the essential features, while typical, are most readily and simply recognized.

A fourth requirement of the illustration is that it shall be significant. Every teacher has been impressed with the frequency with which students when tested seem able to tell everything about an illustration except what it was intended to illustrate. The concrete instance offered was simple and interesting, but no serious effort had been made to advance beyond the concrete to the generalizations. To the pupil who does not infer from the erosion of the Niagara gorge to the phenomenon of erosion in general, the intended illustration has really illustrated nothing. In other words, the illustration is not significant. No less real, though less extreme and less obvious, is the case of the student who can state,

usually in a formal way, the generalization derived, but when asked to illustrate it can cite only the illustration suggested in the class exercise. He has failed to catch the implication of the principle involved, or what is essentially the same, has attempted to generalize from a single instance. Investigation will usually show that his so-called generalization means to him not a general principle but a formalized statement of the chief feature of the illustration studied. It was an illustration which to the student had little or no significance. Calling upon the student to suggest illustrations when the principle is being developed, as well as later, will assist both in rendering them significant and in testing for a knowledge of that significance.

Illustration and Analogy.—Between illustration and analogy it is difficult to draw the line, if indeed a line of distinction exists. Both provide concrete instances which are to assist in interpreting relationships. However, in the case of the illustration, the instance belongs truly under the class concerning which the generalization is made, whereas in the analogy the relationships compared are similar in some conspicuous feature, but the instances cited cannot be classed together for the generalization, since in some essential points they are different. The mathematical analogy given on page 108, wherein algebraic multiplication is compared to arithmetical, cannot itself be employed as an illustration of the latter, since, for the student at least, it deals with a different kind of material. It is therefore essential that in the use of the analogy the pupil be not permitted to mistake it for an illustration, since such a mistake would lead to a false generalization.

Student Contribution.—We have suggested three general principles of development in instruction: procedure from known to unknown, simple to complex, and concrete through abstract to concrete. There remains for our consideration a fourth principle, the importance of the student's contribution. In a previous chapter, as indeed throughout the book, we

have emphasized the activity of the student as the basis of all learning. Unless the class participates almost constantly in the development, instruction loses its distinguishing virtue and falls back to the level of lecturing. The pupil who has supplied data or suggestions in the class discussion, whether he derived them from his past experience, his independent thought, or even his finding of them in the book before him, feels in consequence a real part in the lesson development, and will receive a correspondingly greater benefit. The importance of drawing out the students and challenging them into active contribution is more easy to preach than to practise. Its difficulty is no excuse for its neglect, though it certainly is a prolific cause for it in our secondary schools. To suggest how to secure this student participation in the development of the lesson would be but to repeat what has already been said, in almost every chapter, on the subject of class activity. All we can do here, therefore, is to emphasize anew its importance in the lesson development as the *sine qua non* of developmental instruction.

The same principle of student activity which renders development instruction so serviceable also warns against the error of overinstruction. In the effort to develop new material, and in the enthusiasm of its movement and activity, the teacher is in danger of losing sight of the reciprocal function of the class, and doing with and for the student what the student should do alone and for himself. The class exercise should not be taken as the sole learning activity. On the contrary, it should give the student the impetus, the capacity, and to some degree the materials for work, but so far as possible should leave to him the actual work. Instruction should invariably develop in the student initiative and power of self-direction, and the class exercise should merely start, not complete, the activity of learning. Working out the demonstration of all the advance propositions or exercises in mathematics, translating the advance lesson in Latin, or supplying the details of the advance lesson in history would tend

to render the students not independent but dependent, not pushers but leaners.

Applicability of Lesson Development. — Recalling the statement, made at the beginning of the chapter, that development is the method of teaching new material, or advance work, it must be realized that not all material needs to be taught. Not infrequently the new material is so simple in character and so easily understood that it needs little or no teaching by the instructor. Often it consists of material the independent working out of which is within the student's capacity and is of its greatest educational value only as it is so mastered by the student without help or hint from the instructor. With few exceptions, such material will involve not new methods or principles but new examples and applications of methods and principles already developed in the classroom. The original exercise in geometry, the translation of a passage in Latin, the interpretation of a complex chemical reaction, or the tracing of the military manœuvres in a battle would usually fall under this type of new material, and would at most justify occasional hints from the teacher to help over points of especial difficulty. Such hints, if likely to be needed by a large part of the students, may best be given in the assignment, otherwise as individual assistance to students, especially in the form of supervised study. (*Cf.* page 241.)

4. Typical Forms of Development

Books on teaching usually devote much attention to what are known as the Socratic, the heuristic, and the lecture methods of instruction. This emphasis has done much good, yet not a little harm, the latter being due mainly to a failure to appreciate the spirit of the three types. Moreover, their difference is found to be more seeming than real when they are properly understood and employed.

Socratic Method.—In the Socratic method the instruction takes the form of a cleverly directed dialogue, in which there

are put to the student questions the answering of which suggests to him implications of which he was hitherto unconscious. The instructor tells but little, restricting his activities to a series of questioning which the student blindly follows to an outcome which not he but the teacher had anticipated. The following selection, in which Socrates is leading his followers to a definition of justice, illustrates the use of the Socratic method as practised by the philosopher himself.

What was our definition, Polemarchus?

That a friend is one who seems to be an honest man.

And what is to be our new definition?

That a friend is one who not only seems to be, but really is, an honest man; whereas the man who seems to be, but is not honest, is not really a friend, but only seems one. And I define an enemy on the same principle.

Then by this way of speaking, the good man will, in all likelihood, be a friend, and the wicked an enemy.

Yes.

Then you would have us attach to the idea of justice more than we at first included in it, when we called it just to do good to our friend and evil to our enemy. We are now, if I understand you, to make an addition to this, and render it thus—it is just to do good to our friend if he is a good man, and to hurt our enemy if he is a bad man.

Precisely so, he replied; and I think that this would be a right statement.

Now is it the act of a just man, I asked, to hurt anybody?

Certainly it is, he replied; that is to say, it is his duty to hurt those who are both wicked, and enemies of his.

Are horses made better, or worse, by being hurt?

Worse.

Worse with reference to the excellence of dogs, or that of horses?

That of horses.

Are dogs in the same way made worse by being hurt, with reference to the excellence of dogs, and not of horses?

Unquestionably they are.

And must we not, on the same principle, assert, my friend, that men, by being hurt, are lowered in the scale of human excellence?

Indeed we must.

But is not justice a human excellence?

Undoubtedly it is.

And therefore, my friend, those men who are hurt must needs be rendered less just.

So it would seem.

Can musicians, by the art of music, make men unmusical?

They cannot.

Can riding-masters, by the art of riding, make men bad riders?

No.

But if so, can the just by justice make men unjust? In short, can the good by goodness make men bad?

No, it is impossible.

True, for if I am not mistaken, it is the property, not of warmth but of its opposite, to make things cold.

Yes.

And it is the property not of drought, but of its opposite, to make things wet.

Certainly.

Then it is the property not of good, but of its opposite, to hurt.

Apparently it is.

Well, is the just man good?

Certainly he is.

Then, Polemarchus, it is the property, not of the just man, but of his opposite, the unjust man, to hurt either friend or any other creature.

You seem to me to be perfectly right, Socrates.

Hence if any one asserts that it is just to render to every man his due, and if he understands by this that what is due on the part of the just man is injurious to his enemies, and assistance to his friends, the assertion is that of an unwise man. For the doctrine is untrue; because we have discovered that, in no instance, is it just to injure anybody.

I grant you are right.[1]

While the Socratic method possesses some real merit, it nevertheless has a decided limitation and a serious danger. In the first place, the limitation of its content to the replies of the student restricts its applicability to only a few fields of study. Its data are merely the student's own experience, limited at best, and thus rendering the method almost wholly

[1] The selection here quoted is taken from Book I of the "Republic," by Plato, Davies and Vaughn's translation.

unsuited to such studies as history, foreign languages, and the natural sciences. Its danger, moreover, lies in its tendency to relapse into a mere intellectual assenting by the student to certain propositions suggested by the teacher, even though disguised by being cast in the form of grammatical questions. The teacher imagines that he is asking, whereas he is actually telling in a roundabout way. Unless skilfully employed, the Socratic method neglects the student's activity by its blind leading and its suggestive questioning.

Heuristic Method.—In the heuristic method the plan is to induce the student to find out for himself, instead of telling him the answers to his problems. The purpose is to constantly shift the activity from teacher to student, thus creating the atmosphere of discovery. The leading merit of this method is its emphasis on the activity and initiative secured on the part of the student, and is thus a reaction against the too common fault of doing for the student what the student should learn to do for himself. Like the Socratic method, the heuristic method has its limitations and dangers. No small part of the suitable content of secondary education is of such a character that he cannot discover it for himself. Telling a boy to see what the text-book says at the top of a specified page cannot properly be called "heuristic." The true discoverer does not walk in a beaten and prescribed path, but must in some measure blaze his own trail. Too much of what is called heuristic is quite unworthy of the name. Moreover, a moment's reflection will suffice to show the fallacy of the notion that the high school student is in the heuristic method putting himself in the place of the original discoverer. Professor De Garmo points out three bases of difference between the two. "In determining the whereabouts of the student in the domain of knowledge, we have first to consider that he stands at the frontiers of his own knowledge, not at those of the race. The answers to his problems are known, presumably to the teacher, at any rate to somebody; whereas

the answers to the problems of the investigator are yet to be learned. . . . The investigator, with a mind already stored with knowledge, who has worked for months and even years to establish a set of causal relations or to demonstrate a law, has no difficulty in remembering what he has proved, first, because of the vividness of his conceptions, and, second, because of their limited scope. But the high school student, who must recapitulate in a brief time at least an epitome of the acquisitions of the race, finds it difficult to make one small head carry all he learns. . . . The investigator needs no such admonition, for he gains efficiency through his research. The student, however, is confronted with a double difficulty; for, on the one hand, his researches are numerous and quickly made, so that the time and repetition needed for gaining a high degree of efficiency are denied him, while, on the other hand, he must acquire large amounts of knowledge without even the form of research."[1] True, this mood of the student may most profitably be that of the investigator, and the lessons of self-reliance and initiative to be learned by heuristic study are invaluable. However, it is an abuse rather than a use of the heuristic to fail to give the student in his investigations the benefit of the choice of methods which the original investigator has worked out as most fruitful and direct.

Lecture Method.—The lecture method of instruction in the high school has never been in good repute. Its introduction into secondary instruction can mainly be laid at the door of inexperienced college-trained teachers, who, thinking of education from the point of view of content rather than of student, naturally employ the methods they last saw in use in their own college experience. The lecture method is weakest where the heuristic method is strong, in that in the lecture the student is almost wholly a passive recipient, with no activity of reconstruction or expressive application. So much more ground can be covered in this way that the teacher too

[1] De Garmo, "Principles of Secondary Education," II, pp. 67, 69, 74.

often imagines he is making great headway, whereas for want of expression he is making but little impression, and ultimately he blames his class for failure to work, when the trouble is that he gave them nothing to do. Thus, the weakness of lecturing to high school students is essentially the weakness of wrong distribution of activity between teacher and class, which we considered in our fourth chapter.

In general we may say that all three methods—the Socratic, the heuristic, and the lecture—are by no means universally applicable in the high school. Each, however, has its significance and function. As a means of stimulating the student to reflect upon his experiences, the Socratic method is often serviceable. In leading him to make his own discoveries and to develop initiative in thought, the heuristic attitude is essential. In giving to a class material which is otherwise inaccessible, or the search for which would be a poor economy, a limited degree of lecturing is occasionally of real service, subject ever to the condition that the student thinks as he is being lectured to, and that thought is given immediate and adequate opportunity for expression.

5. The Place of Development in the Class Exercise

Relation to Recitation.—In our treatment of the propædeutic function of the recitation element, we have implicitly determined the place of the development activity. As the recitation serves to render fresh in consciousness the material for the starting-point of the advance work, so the principle of the procedure from the known to the unknown would imply that development would normally follow recitation. In Herbartian methodology, inductive development would correspond in a general way to the three steps of presentation, comparison, and generalization. However, our use of the term is broader than the Herbartian, since it covers not merely inductive procedure but all the forms of problematic and appreciation instruction.

The requirement that development shall follow recitation does not imply that all of the recitation shall have been completed before the development can begin, though such is, in some studies at least, the more natural procedure. What is meant is that recitation is to be the first step in a sequence in which development is the second. It may be that only a small section of the prepared lesson is recited upon, and then is at once followed by the development of the new material for which it is the preparation. This in turn may be followed by its application and expression, and then by the recitation upon further old material, or its application and expression may be postponed until further recitation and development have been introduced. In not a few cases, the recitation and development may be so blended as to be almost indistinguishable. Some of the best teaching the author ever observed, more especially in linguistic and literary studies, has been of this latter type. It is, however, subject to the danger of deteriorating into mere recitation with commentary by the instructor, and with but little training in the logical development of thought.

A few examples will perhaps serve to show more clearly the relationship between recitation and development. In teaching the factoring of expressions of the $x^4 + x^2y^2 + y^4$ type, the recitation would naturally be upon the factoring of such expressions as $x^2 + 2xy + y^2 - z^2$, which presumably had formed the basis of the home study in preparation for the day's lesson. The axiom that "if equals be added to equals the sums are equal" might also be recalled. Then, after the recitation, including board work and the clearing up of difficulties, the new type of expression is presented and the activity of the class is challenged by the announcement that its factoring involves no method or principle which is essentially new. The development of the solution will follow. In this case the two steps of recitation and development are distinct and successive.

With a class in American history, the lesson prepared for the day may have dealt with several only partially related topics, such as John Brown's raid, the first election of Lincoln as President, the beginning of the secession movement, and the firing upon Fort Sumter. These would naturally form the content for the recitation procedure. Out from each of these in order, however, the related topic or topics next to be studied might profitably be developed immediately, before the recitation and development based upon the succeeding topic are undertaken. Thus, the recitation upon John Brown's raid might be followed by the development of its effect upon Southern sentiment toward the abolition movement in the North; then might come the recitation upon Lincoln's election, followed by the development of its effect upon Southern hopes for the permanency of slavery as a national institution, and so on.

In the study of a literary selection, the two types of procedure might be even more intimately interwoven. Recitation upon facts and impressions derived from the study of the selection might almost constantly be expanded by further and more intensive consideration, or by an attempt to secure the appreciation of that which hitherto had been studied primarily for content.

Relation to Assignment.—The lesson development has essentially to do with the work which the student is to prepare for the following class exercise, and is therefore closely related to the lesson assignment. Indeed, the development is not infrequently known as the lesson assignment, although strict adherence to the meaning of the words would give to the latter term a far narrower denotation than to the former. Strictly speaking, the assignment refers to that part of the instruction in which the work for the student to do in preparation for the next day is formally stated, whereas the development is an instruction process, working out in the class exercise the general principles or data which form the

starting-point or basis for the pupil's home study. The function of the lesson assignment as a part of the lesson will receive fuller treatment in a subsequent chapter.

We have seen that the development instruction may take either of two forms, according to the character of the situation from which the thought of the lesson proceeds and the student's response to it. To each of these forms of development, the problematic mode and the appreciation mode, we must give special consideration, in the two chapters which follow.

6. Summary

In dealing with advance work in instruction, the procedure consists of four steps: the student's knowledge of the new situation, its appeal to him, his response to it, and his expression and application of that response. The response may be of either the intellectual or the appreciation type.

Lesson development is the inducing and directing of that response, and involves joint activity on the part of both class and instructor.

Development instruction should accord wholly or in part with four general principles: (1) It should proceed from the known to the unknown. Analogy, when used with discrimination, serves in such procedure. (2) It should proceed from the simple to the complex. (3) It should proceed from the concrete through the abstract to the concrete. The use of illustration is a form of such procedure, and is of especial value when the illustration is familiar, accurate, simple, and significant. (4) The class must participate actively in the development.

The Socratic, heuristic, and lecture methods are not sharply distinct from each other and even less from the development procedure. The essential features of each are respectively the provocation of student thought by a chain of questioning, the attitude of discovery on the part of the student,

and the extended oral supplying of data to the class by the instructor.

The place of development in the class exercise is naturally after the recitation procedure, although often interwoven with it.

QUESTIONS FOR DISCUSSION

1. The term "development" is by some writers restricted to that form of instruction wherein the teacher by skilful questioning merely brings to the child's consciousness the implications of what he already knows. Wherein is the term used more inclusively in this chapter?

2. Why would it not be better not to employ development, but instead to merely direct the student to learn the lesson out of the book? Would such procedure tend to increase or decrease the degree of mechanical memorizing of lessons?

3. "Proceed from the known to the unknown." In the study of the conjugation in Latin or French, how might this principle find application?

4. An algebra teacher, developing the concept of positive and negative numbers, likened their relation to that of a balloon carrying ballast; also to a children's seesaw. Discuss the pedagogic merit of each analogy.

5. Many text-books are arranged to introduce each new topic with a formal statement of the principle to be taught, followed by illustrations, and then by problems. Criticise this arrangement. Examine some standard text-books for examples of such arrangement.

6. Is there danger of giving too many illustrations of a principle? How many illustrations should be given?

7. In developing the topics of glacial erosion, or of taxation without representation, or of the use of conditional clauses in some foreign language, what illustrations would you use in each case?

8. Suggest some material which might better not be developed but instead left for the student to master independently.

9. Some writers advise teachers to place the development at the beginning of the class hour, and to follow it with the recitation procedure. Discuss the advantages and disadvantages of so doing.

SUPPLEMENTARY READINGS

Dewey, "How We Think," chap. I.
Parker, "Methods of Teaching in High Schools," chaps. XII, XVIII.
Bagley, "Educative Process," chap. XVII.

Colvin, "An Introduction to High School Teaching," chap. XII.
Adams, "Exposition and Illustration," especially chaps. VIII–XVI.
De Garmo, "Principles of Secondary Education, Processes of I struction," chaps. VIII, XI.
De Garmo, "Interest and Education," chap. XI.

CHAPTER VIII

THE PROBLEMATIC MODE

1. Character and Function

Meaning of Problem.—In the preceding chapter we observed that in the development of new material there are involved the three elements which we call the student's knowledge of the situation, its appeal to him, and his response to it. Although there is necessarily a certain degree of expression involved in these three steps, and especially the third, the expression-application as a distinct procedure specifically provided for may best be treated as a distinct step following from the development rather than as constituting a part of it. When the response was essentially an intellectual one, involving knowledge or thought rather than feeling as its essential feature, the mode of development was called the problematic mode. This must not be taken to mean that the response alone is the problematic mode; rather, the whole procedure, including all the three elements of development just mentioned, is the problematic mode of development when the response is of this intellectual character.

The word "problem" as used in reference to instruction has a meaning somewhat broader than that which is frequently attributed to it. Whenever the student feels that the situation confronting him is one that demands his thought and study, one which challenges him to find out or think out something, to attain to a knowledge or conclusion not yet attained to, that situation is to him a problematic one. With Professor Dewey, we would apply the term to "whatever—no matter how slight and commonplace in character—perplexes and challenges the mind so that it makes belief uncer-

tain,"[1] meaning thereunder to include any situation which impels the student to discover more facts about it, or to think out its implications, whether as generalization or as concrete application. "The problem," says Professor De Garmo, "is well-nigh universal in every field of endeavor, educational and vocational, for whenever the adjustment of thought to fact or of fact to thought is involved, there the problem lies close at hand. That it is of supreme educational importance in the sciences cannot be doubted; it is equally serviceable in the humanities whenever the student should be incited to think. History easily resolves itself into a series of problems respecting cause and effect. Every literary masterpiece fairly bristles with problems psychological, social, ethical, and linguistic. Even the purely æsthetic, whose appreciation is usually considered to rest upon contemplation alone, is greatly aided by intellectual comprehension, which always permits the problem form." [2]

Repeatedly the reader has been reminded of the importance of student activity; that the student must be in the attitude of the aggressive seeker after knowledge and power, and not a mere passive recipient. In the problematic mode, therefore, the first condition for learning must be the problem attitude on the part of the student. This involves an open-mindedness for the recognition of problems, and a determination to solve them. To too many people, the situations of life are but matter-of-fact things, to be gotten on with in the easiest way. To the student these must, to use Professor De Garmo's expression, fairly bristle with problems which demand consideration. The boy who sees in the compass needle merely a toy or a useful instrument will learn nothing from the compass. Only when its workings set him to thinking and finding out will the compass be an educative agency for him. The ability to develop this attitude of mind on the

[1] Dewey, "How We Think," p. 9.

[2] De Garmo, "Principles of Secondary Education, Processes of Instruction," II, pp. 23–24.

part of his class is vital for the effectual teacher, and for the student the attitude is a prophecy of success within and without the school.

School work abounds in problems. Thus, the history student desiring a better understanding of the battle of Gettysburg will want to know the topography of the battle-field, the relative strength and positions of the opposing armies, and the strategic aims of the commanding generals. These and related data constitute for him what might be termed a "finding-out" problem. Somewhat different is the case of the student in physics who from his study of the appropriate apparatus before him is seeking to discover a general law for the relation between the length of pendulum and its rate of vibration. Here we find a "thinking-out" problem, obviously of a higher intellectual order than the preceding, and involving the logical procedure of induction. A third type of problem is that of the algebra student who, knowing that the difference of the squares of two quantities is the product of the sum and difference of the quantities, is endeavoring to factor the expression $a^2 - b^2 - 2bc - c^2$. His problem, too, is one to be "thought-out," but the thinking in this case is deductive.

Relation of the Three Types of Problem.—Problems are thus seen to be of the three types: informational, inductive, and deductive. The first concerns itself with the discovery of concrete data, the second with the derivation of abstract principles from those data, and the third with the application of those principles to further concrete situations. Any one of the three may, as we have seen, constitute a problem for the student. All three of them form a series of thought such as we observed in Chapter VII,[1] where it was seen that the true pedagogical procedure in developmental instruction is from the concrete through the abstract and back again to the concrete. Each of the three may thus be itself problematic and at the same time propædeutic to the further procedure in

[1] P. 110.

the thought series just mentioned or in further series proceeding from it.

2. Sources of Information

First in order of sequence, though not of educational value, is that type of problematic procedure which we have termed the informational problem. Whether the student intends to employ that information as the basis for a subsequent induction or seeks it merely to gratify a desire for knowledge about something in which he has an interest, his "finding-out" procedure is essentially the same.

Telling, Reading, and Discovery.—The schoolboy gets his knowledge of the world in three ways: somebody tells him, he reads it, or he discovers it for himself. In the classroom these three sources of information are still the fundamental ones: the telling by the teacher, the reading of the text-book, and the observation by the student. The two first named constitute authority in instruction, whereas in the third the student goes for his data directly to the originals, in so far as these are accessible and interpretable for him. Of these sources of information, at least the first two and often all three are available in teaching. However, each has its merits and its limitations, its advantages and disadvantages, to be taken into account in determining which source shall be employed in any particular instance.

Telling by the teacher as a source of the student's information has long been the object of severe criticism. The chief objection raised, and one not without justification, is the danger that it will resolve itself into a one-sided activity, with the teacher doing all the work and the class remaining passive and inert. The danger is real but not so fundamental that it cannot be met. True, it is so easy for the teacher to seemingly impart knowledge by telling that he often overlooks the response of his class. However, it is often possible to so "tell" students that they are constantly active and on the alert, responding in thought and even in word to what

the teacher is relating. "Telling" when such an atmosphere as this prevails is not harmful, and may be employed at times to excellent advantage.

Of the advantages of the "telling" procedure in instruction, probably the most significant is its adaptability to the special needs of the situation. The teacher, knowing what he intends to accomplish by the lesson in hand, is able to select and organize his data for the best realization of his specific aim, and to present it at what might be called the "psychological moment" for its educational effectiveness.

A second advantage and one that plays a real part in the deepening of impressions made lies in the vivacity and personal responsiveness which may characterize such presentation. We are glad to spend a dollar to hear a lecture delivered, even though we know that a few hours later we could read the same address in the daily newspaper at negligible expense. So the teacher, if possessed of the capacity for "telling," can thus vitalize matter which if first read by the student would be dull and uninteresting. We might advantageously adopt the practice of the Germans in including in teacher-training the development of power to "tell" and even the untrained teacher can, by observation, practice, and sympathy with students, increase greatly his efficiency in this direction, to the delight of both himself and his pupils.

A further advantage of the "telling" procedure lies in economy of time. Many facts are not easily accessible for the student, so that his expenditure of time and effort in finding them more than offsets the advantage of his activity in the finding. While ever mindful of the danger of doing the pupil's work for him and of mistaking haste for progress, still we must realize that any procedure which can effect a real economy of time in instruction has a positive pedagogical function.

The second source of information for the student is the text-book, with the supplementary books of reference. The old conception of the class exercise as a place for reciting

memorized material instead of for learning has tended toward the banishment of the text-book from the classroom for all purposes save that of an exercise book. Few teachers really know how to use the text-book in the class exercise, failing to differentiate between its use and its abuse.

As a source of information in instruction, the text-book has three real advantages. First, it represents, or is supposed to represent, a higher quality of presentation and exposition than that of which the average teacher is capable, so that when his own exposition proves inadequate or he wishes to follow it up with one which is better as a final form, recourse to the text-book is occasionally of real service. A second advantage lies in the fact that the material of the text is available for reference for the student when in his study he seeks to recall the material developed in the classroom. What the teacher tells is told but once; what the text-book tells is accessible at will. The third advantage is derived from the appeal to the visual as well as to the auditory. What one sees on the printed page comes into consciousness by a different avenue of entrance, the eye rather than the ear, thus deepening the impression, especially in the case of visually minded students.

The information material thus far discussed has been that based upon authority. The third type, that derived from the student's own experience and observation, has, when available, merits which give it first place in order of educational value. When the observation is made in the class exercise or laboratory, and is therefore purposive and directed, it tends to develop in the student a high degree of self-reliance and power of observation, qualities which are by some considered the most valuable products of education. In such case, the student feels the interest of investigation, which forms the basis for problematic study. And whether the observation be made during the class exercise or in the earlier experience of the pupil, its concreteness and personal element increase greatly the depth of the impression made by the instruction based upon it.

Employment of the Sources.—Simple though the information procedure may appear, a few suggestions regarding its employment in instruction may be of value.

"Telling" by the teacher is always in danger of deteriorating into a one-sided activity with the students almost wholly passive, often uninterested, and the instructor reciting phonograph-like a series of facts for the class to memorize. Skilful "telling" is such that the demand is created before it is supplied; the class want to know before they are told. Herein lies one of the most potent forces which can be employed in the arousal of student interest and activity. The class should be induced to ask questions, the answers to which involve the information to be conveyed. Thought should stimulate thought, questions should stimulate answers, and answers further questions.

In harmony with the above are Professor Dewey's three requirements of "telling" in instruction. "(i) The communication of material should be *needed*. That is to say, it should be such as cannot be readily attained by personal observation. . . . (ii) Material should be supplied by way of stimulus, not with dogmatic finality and rigidity. When pupils get the notion that any field of study has been definitely surveyed, that knowledge about it is exhaustive and final, they may continue docile pupils, but they cease to be students. . . . (iii) The material furnished by way of information should be relevant to a question that is vital in the student's own experience. Instruction on subject matter that does not fit into any problem already stirring in the student's own experience, or that is not presented in such a way as to arouse a problem, is worse than useless for intellectual purposes."[1]

But good "telling" concerns not content alone but method. Attention must be given not merely to what we tell but to the manner and form of the telling. The teacher should train himself in narration, description, and exposition. He should be able to recount an event or paint a word-picture

[1] Dewey, "How We Think," pp. 198–199.

so clearly and vividly and with such balance of accent and feeling that the class really see the original through his eyes and catch the spirit of his observation and interpretation. For this he will need a certain degree of vividness of imagination and sympathy of manner which are the product not merely of native ability but, to no small degree, of training as well. Exposition, dealing more with logical relationships, demands a thorough understanding of the content and its organization. Clearness of thinking is a prerequisite of clearness of exposition, and much of the weakness of exposition in instruction can be traced back to the fact that the instructor did not know exactly what he wished to say and how to say it. A habit of careful and full outlining of his material both in his preparation and in his instruction will usually prove of value in securing clarity of exposition.

When shall the teacher *read* to his class, rather than "tell"? In view of the greater interest and vividness of the told than of the read, it is evident that other things being equal, telling is better than reading. However, we have seen that reading has its merits as well as its demerits, and that one of the former is the possibility of better form of expression. In general, unless the written (or printed) form is conspicuously better than the spoken form of the teacher's instruction, or the *form* of expression is one of the vital considerations in the material, it is better to tell than to read. Not infrequently, however, especially in literary and linguistic study, the form is an essential or is so far superior to the teacher's telling that the reading is helpful and justified.

We have seen that one advantage of the text-book as a source of information lies in its availability for reference in subsequent study. This disadvantage of the "telling" procedure can in some measure be offset by requiring students to take notes upon what they are told. Such notes, when the student has been shown how to take them and use them, may be of great value to him in his study by recalling to him both the content and the organization of the study material

as developed in the class exercise. Note-taking has the further value of calling the class to activity; not merely the physical activity of writing, which for high school students is of positive service, but the mental activity of selecting, organizing, and formulating, which is one of the most beneficial forms of intellectual training. "No notes," says Professor Chubb, "are to be made for the sake of mere recall, but for the sake of the powers called into play in making them. In their simplest form, they should involve some selecting and organizing of data. These data should be organized in such a way as to tell their story by their appearance—clear heading and subheadings, and well-articulated outlines. . . . We must not overlook, however, the value of the mere writing up of rough notes as compelling the student to recall and rethink the living commentary and discussion of the class."[1]

In the employment of the third source of information, the pupil's own observation, the teacher must guard himself against misconceptions regarding the meaning of student discovery. As we saw in our study of the heuristic method (Chapter VII, p. 121), the high school student is a discoverer in spirit only, rather than in fact. "Does the pupil believe himself to be discovering the truth?" asks Professor Bagley. "This is the essential point. As long as he is confident that he is discoverer, the essential condition of the development method has been fulfilled. In other words, it is the *subjective attitude* of the pupil that is important rather than the *objective process*."[2] In the strictest sense of the term, then, the high school student is rather the investigator than the discoverer, and the teacher must not expect him either to discover in the same way that the original discoverer employed, or independently to find and select the materials wherewith to proceed. The problem, the method, and the instruments available for the student all presuppose procedure with a con-

[1] Chubb, "The Teaching of English," pp. 280–281.
[2] Bagley, "Educative Process," p. 263.

siderable degree of knowledge, of selected and adapted conditions, and an attempt to convert the high school pupil into the original discoverer is an unnecessarily wasteful procedure. Let him catch the *spirit* of investigation, and conduct it with the best aids available. When the bridge has once been built, it is thereafter unnecessary to ford the stream.

We have treated the three sources of information as though they were distinct, and have suggested how each may be employed. However, here as elsewhere in method, the instructor will employ any and all of the sources as occasion may demand. Skill in teaching consists in the ability not merely to choose but to synthesize methods. So, in the same lesson there may be resort to telling by the teacher, reading by the student, and reporting of observation and experience by the class, the whole being blended in a synthesis of elements chosen each in response to a demand for which it is peculiarly adapted.

It need scarcely be pointed out that the learning in the finding-out problem is based upon simple association. The situation which raises the problem has directly and simply associated with it the fact or idea which completes it as the solution of the problem. And however valuable the information acquired may be, it will be readily seen that the range of its application extends only over that comparatively limited field in which the facts in question function. Information is far more narrow in its usefulness than is thought power, and the teacher must be on his guard lest he give undue attention to mere finding-out problems in teaching. The transfer of information, like the transfer of training, is possible only in so far as there are common elements between the known situation and the new one, and in information as compared with thought power the number of such elements is but small. The knowledge of the English equivalent for *tuba* or of the method of bisecting an arc, however useful, has far less range of application than the power to observe or to reason.

3. Composition of an Act of Thought

The Steps in Thinking.—The problematic procedure with which we have just dealt is that in which the pupil acquires information, either by hearing it, reading it, or observing. It is essentially a problem of knowing. On a higher intellectual plane, and involving a far more difficult task, is the problem which involves *thinking out.* It may be the derivation of a general principle from given concrete data, or it may be application of a general principle in the solution of a particular situation. In logical terms, the problem may be either inductive or deductive, or indeed may involve both logical processes.

In all problematic procedure, a complete act of thought involves four fairly distinct steps. These are, first, the recognition and formulation of the problem;[1] second, a tentative solution or hypothesis; third, reasoning out the implications of the solution, and, fourth, the verification.

Stated in terms of the principle of association, we find that the problematic learning of the thought type involves a complex system of both association and dissociation, of analysis and synthesis. In the first of the four steps, the student encounters the situation as a unity, and proceeds to analyze out its problematic elements. In the formulation of the hypothesis, he associates tentatively these problematic elements with others. The next step, the reasoning out of the implications, is essentially an analytic one, in which the synthesis thus formed is subjected to a further analysis. In the verification, the synthesis of the second step is reformed with new subordinate elements included.

Thus, the questions the student asks are these: 1. What is the problematic feature of this situation, and what is there problematic about it? 2. What combination of this prob-

[1] This step Dewey treats as two, which he calls a felt difficulty and its location and definition. *Cf.* Dewey, "How We Think," p. 72.

lematic feature with known data seems to satisfy? 3. What features are involved in this combination which might affect its validity? 4. With these newly considered features involved, can the old combination be satisfactorily reformed? As thus stated, the analysis-synthesis-analysis-synthesis movement of thought is isolated and rendered more evident for our study.

The chemistry student, directing the hydrogen flame against a porcelain dish, sees the metallic mirror surface formed upon the dish. The problem occurs to him: "How can this happen? What is the cause of the phenomenon?" The tentative solution suggests itself: "Possibly the zinc used in the hydrogen generator contains arsenic, and the mirror surface is a deposit of arsenic." He proceeds to reason out the implications of this hypothesis, recalling that not only arsenic but antimony as well would deposit such a mirror, but that commercial zinc more often contains arsenic than antimony. Finally he verifies the arsenic hypothesis by dissolving the metal in acid and treating it with hydrogen sulfid, and thus identifies it as arsenic by the color of the precipitate.

Literature offers its problems as well. In the reading of "Macbeth," the student raises the question whether Macbeth's hesitancy about killing Duncan is due to moral considerations or personal cowardice. He forms the hypothesis that it is due to cowardice alone. Reflection suggests to him that in such case the hesitancy would cease when Macbeth is shown that the act can be committed without danger of detection. However, an attempt at verification shows the inadequacy of the hypothesis, since Macbeth still hesitates despite this assurance. The student is thus compelled to revise his hypothesis, and to attribute Macbeth's conduct to a combination of both the motives mentioned. Reflection upon this new hypothesis suggests implications which both word and deed of Macbeth seem to justify, and this hypothesis, thus verified, is accepted by the student as the solution of the problem.

In the study of history, the student often encounters a problem in which he is led to form an anticipatory judgment of the outcome before that outcome itself has been encountered. In the interpretation of a certain legislative action, he forms a hypothesis as to the economic disturbances that will follow. Finally, the further reading of the reference provides the basis for the verification of his anticipatory hypothesis.

A problem from the study of Latin may suffice for further illustration. "Patriam cum severitate regam." The beginning student is confronted by the problem whether "cum" is here used as a preposition or as a conjunction. The fact that it is followed by an ablative suggests the hypothesis that the former is the case. Consideration of the implication shows that according to the hypothesis there could be but one verb in the sentence, whereas the use of "cum" as a conjunction would involve two verbs. The hypothesis is verified by observation that but one verb is to be found in the sentence, and is further supported by the fact that that verb makes better sense as a future indicative than as a present subjunctive.

The studies of the high school curriculum abound in problems such as these, though of widely differing degrees of complexity. Sometimes the hypothesis may take days in the formulation and weeks in the verification. Again, as in the case of the Latin illustration, it may occupy but a few minutes, and may be so simple that the student is unconscious of the fact that he has even formed an hypothesis. The difference, however, is rather one of degree than of kind, for the logical procedure in a complete act of thought is always essentially the same.

Induction and Deduction.—Books upon method have said much, possibly too much, on the subjects of induction and deduction in instruction. Teachers have been led to believe that in practice as well as in theory the two processes are to be sharply differentiated. Some have even gone so far as

to treat them as two alternative methods of teaching any particular fact, and have declared that the inductive is the better and the one always to be selected. While not wholly false, such a doctrine is misleading to the teacher, and is based on an inadequate conception of the learning process. While the logician differentiates between inductive and deductive reasoning for the purposes of his science, the student is constantly employing both, often inseparably, in the act of learning. Moreover, whether the learning is predominantly induction or deduction is determined by the character of the problem, whether the discovery of a general principle or the employment of a general principle or principles in the solution of a particular problematic situation.

Any step in the circle of thought is a problem in so far as it "perplexes and challenges the mind so that it makes belief at all uncertain." [1] If the solution is more general than the data from which it arises, it is an inductive procedure. If it involves the application of general principles to cases which are less general, it is deductive. An entire act of thought may be predominantly either inductive or deductive on this same principle, though both types of thinking may be involved in either. Thus, the derivation of the law of falling bodies is an inductive problem, although some of the thinking involved is deductive. The proof that the diagonals of a parallelogram bisect each other is deductive reasoning, although there is somewhat of induction in the demonstration.

4. Procedure in the Thought Type of the Problematic Mode

We have seen that learning involves the three method factors of acquisition, reflection, and application or expression, and can scarcely have failed to catch the inference that the first and second of these, the acquisition and the reflection, correspond to the informational and the thought types of

[1] *Cf.* p. 129.

problematic procedure, as treated in the second and third sections of the present chapter. With the application and expression we will deal in a subsequent chapter. The requirements of the informational problem have already been considered at sufficient length. Partly because of its frequent use, partly because of its complexity, the reflective or thought problem is of special importance to the teacher in dealing with each of the four steps of thought[1] and demands a large share of consideration at his hands.

1. The Recognition and Formulation of the Problem. Definiteness of Problem.—A first essential of the problem is that it be definite. Not merely the teacher but the student as well must know definitely just what the problem is which confronts him. Doubtless if there is one difficulty which more than others hinders students in the solution of problems, it is the failure to catch their meaning and implications. What was said earlier regarding the clarity of questions holds with equal force of problematic instruction, for although the responsibility for the deficiency may be differently placed, the defects in the solution are similar in character. Students are prone to undertake the answer of a question or problem before they really catch the force and significance of what is asked. Not merely does the practice of permitting this indefiniteness of problem thwart the accuracy of results, but it establishes in the student the unfortunate habit of engaging in undertakings hastily and without due consideration of what they are doing, a habit fatal not alone to scientific accuracy but to efficiency in all of life's activities. The student should early be led to realize that a start in the wrong direction merely adds to the distance to be travelled, and is thus worse than no start at all.

One of the forms of such indefiniteness of problem is the failure to differentiate between inductive and deductive problems of instruction. The distinction is one which constantly confronts the high school teacher, and unfamiliarity with

[1] *Cf.* p. 139.

which is a not infrequent source of inaccurate, unscientific instruction.

The inductive problems of the high school curriculum are usually of two types, either the formation of a class for purposes of classification, or the discovery of a causal relationship.[1] The former type, which is based upon similarity, might be illustrated by the classification of prepositions according to the case which they govern or of rocks according to their crystalline structure. The second type, based upon a relationship of causality, would include such cases as that of the discovery of the dependence of vibration rate of pendulum upon length of pendulum. Both types lead to the establishment of a class or principle which can be employed in the classification or explanation[2] of a group of other individual cases not considered specifically in the course of the induction.

The deductive problems are of various types, yet are all characterized by one distinguishing feature, viz.: the explanation of a given particular situation by means of the application of general principles already established. In algebra, the factoring of $x^3 - y^3 - 3y^2z - 3yz^2 - z^3$ involves the problem of showing that it is the difference of two cubes, and that its factors are such as follow naturally from such a situation. The problem of the explanation of the electric telegraph is solved by showing that it is but an application of certain laws of electrical action. The demonstration of a geometrical proposition consists in pointing out that the conclusion is merely an implication of principles already well established. The interpretation of the manœuvres of Lee's army at Gettysburg is possible only when they are seen to have been involved in the general plan of a Northern invasion. Stimulating a civics class to anticipate the effects of

[1] De Garmo, "Principles of Secondary Education, Processes of Instruction," p. 77.

[2] The student of logic is already familiar with the fact that explanation is but a form of classification.

the direct election of United States senators is an appeal to deductive application of general civic principles to an imagined situation.

The pedagogical importance of the distinction between induction and deduction, although commonly much overestimated, is nevertheless real. Both teacher and pupil should know definitely just what they are seeking in any problematic procedure in order that means may be adapted to end and that it may be known with assurance when the problem has been accurately solved. The student may not even know the meaning of the terms induction and deduction, but he should know definitely whether he is seeking a general principle or the explanation of a particular problematic situation. In an earlier chapter we saw how prone the student is to stop with the concrete illustration instead of going on to the abstract principle which it illustrates. This is evidently but another way of saying he does not realize that he is seeking a generalization rather than a particular fact, or, in other words, he is not aware of the inductive character of his problem. On the other hand, the student is often satisfied with an inadequate explanation or demonstration because he fails to realize that the case involved in the problem is really a concrete application of the principles from which it is derived.

If to the student, much more to the teacher is it essential that the type of problem be adequately understood, since the teacher is to be the stimulator of the problem and the guide in the quest for its solution. The errors into which he is in danger of falling are the same as those which we have mentioned as threatening the student, but because he is the leader, with nobody to correct his mistakes, the harm occasioned by his mistakes is far the more serious.

Because of his limited knowledge of the subject matter and its implications, the student may easily suppose he understands his problem when he does not. How often when asked, "Do you know just what it is that you are seeking?" he will with perfect conscientiousness reply in the affirma-

tive, when the outcome of his subsequent efforts shows that he was mistaken. The teacher should not take the student's word for it, but may wisely require him to definitely formulate the problem, not merely as an evidence of its comprehension but, still more, for the sake of the definiteness of thought which such formulation produces. In the study of mathematics and to a considerable degree in the physical sciences, the importance of an exact formulation of problems by the student has become generally recognized, due in part to the fact that in the exact sciences problem formulation is more definite and simple, in part to the greater prominence of the problematic element in them. To this, the explicitness with which the algebra student outlines his problem before its solution and the completeness and definiteness of the laboratory instructions in physics bear witness. In the humanities the problematic element is less obvious and more often overlooked. Too frequently the student of history thinks of the events leading to the Revolution rather as memory content than as problematic, so that no formulation of the problem which he should be seeking to solve is even thought of. The same could be said of the treatment of the conjugation in the Spanish class, the choice of the President's cabinet in civics, and even of the motive of Brutus in "Julius Cæsar" in the study of literature. Possibly the adequate oral reading of a literary selection, in contrast to the slipshod reading so often heard in high school classes, might be considered an instance of such formulation. If in the humanities, as well as in the sciences, the student is led to a definite formulation of the problem involved, he will discover far more meaning and profit than is usually the case. Yet even in mathematics and the sciences incomplete and inaccurate statements of the problem are too often permitted, at the sacrifice of much of the exactness of thought and expression for which those studies are justly valued.

Realness of Problem.—The second essential of the problem is that it shall be a real one for the student. Just as the

question must be adapted to the student,[1] so the problem must be one that arises out of his own experience. A problem is not an unreal, made-to-order task set for the student as a form of mental gymnastics, but arises out of a larger whole or situation which confronts him and the challenge of whose problem impels him to an active search for solution. Without the real situation as a background there can be no real problem as foreground. Counting the number of occurrences of a peculiar idiom in one of Cicero's orations may have a considerable degree of reality for the classical philologist, but possesses none for the schoolboy, because there is nothing in his experience upon which it bears. Problems without number could be devised, but nobody ever solves them until they are found to bear on already conscious interests, and the principle holds good with individual school children as with the race. The situation out of which arises for the Latin student the problem of the third conjugation is principally his previous experience with the first and second conjugations. That for the first conjugation is his knowledge of the English conjugation. In the study of stream erosion it is his observation, past or present, of the phenomena of the stream he knows. To the girl in domestic art, the problem of harmony in room furnishings may well arise out of the question "What kind of rug would be appropriate for this dining-room?" In the same way, each lesson is an exercise the occasion for which has arisen from the lessons which had preceded it, either immediately or more remotely, thus securing continuity as well as incentive.

Thus a problem should appeal to the student as practical, and bearing upon the affairs of his active interests. In a recent experiment, a zoölogy class was taught in two sections, of equal ability and with the same instructor, the sole difference being that in the one section the material was treated in the usual way, in the other the economic aspects were prominently emphasized. Although the final examination of

[1] *Cf.* p. 63.

both was based upon the work of the section first mentioned, the students of the second section showed in the examination far the better knowledge of the subject. The explanation is simple, viz.: a greater degree of reality in the problems when given an economic application led to better interest and comprehension. In similar manner, such studies as physics, Spanish, and trigonometry can be made to have a special appeal by emphasizing their value in manipulating electrical machines, in conversing with Mexicans, and in land surveying respectively.

Applications such as the above readily appeal to the typical high school student. But it must not be supposed that he identifies economic with practical value. He likes to think quite as much as he likes to earn money, provided the problem be well chosen and rightly treated. In the words of Professor De Garmo: "As soon as the school work assumes the form of problems to be solved by the self-activity of the pupils, we have at once a concrete application of the doctrine of interest, provided, of course, that we can make the end seem to the pupil worth striving for, and can render it natural for the interest to cling to the steps of the solution as well as to the attainment of the end. But it is to this form of work that children most readily respond."[1] Problems may thus be intellectually real, of interest not because of economic value or of service in facilitating the doing of things, but quite as much because of the intellectual activity involved in its solution, or of the knowledge to which it leads. Thus appeal is made not merely to the interest of expression but of curiosity and of mental activity as well. Problems of this type abound and often predominate in practically all fields of high school study, although if they do not eventually lead to some form of direct application the zest of intellectual effort will be dissipated, and the student will justly declare the work impractical.

A recognition of the importance of the realness of prob-

[1] De Garmo, "Interest and Education," p. 206.

lems has in the past few years manifested itself in several suggestive movements. A few years ago some teachers of mathematics undertook to formulate a larger number of "real problems" in algebra.[1] Such problems were contributed by teachers all over the country, and a strong impulse was given the movement toward the real. However, in too many cases the teachers lost sight of the principle stated in the preceding paragraph, and mistook "real" to mean "derived from the student's out-of-school activities." The suggested problems dealt with automobiles and race-tracks and similar interests, but overlooked the fact that the real interest of the problem lies not in the construction of an imaginary race-track, of itself interesting to but a small minority of girls and boys, but in the intellectual activity represented in the solution of the problem.

The Project Method.—Another phase of the same movement is what is known as the "project method" of teaching, especially in the natural sciences. The idea seems to have had its origin in the sphere of vocational education, and to have been taken up by advocates of general science. To both types of study it is peculiarly adapted. The plan is to abandon the traditional organization of subject matter, but, letting the problem arise out of the everyday experience of the children, to discover in the course of the solution of the problem the principles upon which it is based. In the organization of content into teaching units, we are told, the traditional tendency has been to follow not pedagogic but logical principles. The new movement tells us that if the boundary-line between algebra and geometry or between linguistic and literary study does not represent the natural line of cleavage in the child's thought and experience, we must remove the old landmarks and run out new lines. "Organization of subject matter," we are told, "must be made around the knowledge of the pupil, not around that of the teacher or

[1] *School Science and Mathematics*, March, 1909, p. 307, and several succeeding issues.

syllabus maker." [1] Thus, one might start his study of chemistry directly from the problem of the burning of the candle, and the solution of that problem would lead the student into the discovery of the great group of chemical facts and principles involved. Further "projects" would be the investigation of the wireless telegraph, the construction of a bookcase, or the combating of an insect pest.

The arguments usually advanced in favor of the project method are these: In the first place, each problem possesses unity because of its clearly defined aim in the student's mind. Second, its problems are real problems to the pupil, and consequently their solution has a positive and appreciable value to him. The third and distinguishing feature of the method lies in the fact that the pupil utilizes already acquired knowledge and skill, and attains to new knowledge in the fulfilment of the project.[2] Finally, the method of study is almost exactly that whereby problems of extra-scholastic life are met and solved, so that both the training in method of procedure and the disposition to use school-acquired training function after the completion of the school course.

But the path for the advocate of the project method is not free from obstacles. In the employment of the method, especially in the laboratory, the teacher often meets the practical problem of administering the work with perhaps twenty or thirty students each working out a problem of his own suggestion. At the same time, the working out of many projects involves drawing upon a great variety of fields and of sources of material, many of which are not available even in the best-equipped schools. These are difficulties of administration, which the advocates of the method believe can be met. More fundamental are the objections to the principles involved, as offered especially by teachers of biology. They

[1] Woodhull, "Science Teaching by Projects," in *School Science and Mathematics*, vol. XV, p. 229.

[2] Sneddon, "The 'Project' as a Teaching Unit," in *School and Society*, vol. IV, p. 421.

tell us in the first place that the project method is unsystematic in its organization, losing sight of perspective and of relationships between various parts of the science.[1] Further, we are told that the method fails to give students a comprehensive and well-organized training in fundamental principles.

The entire project movement is as yet in its infancy, and like infant movements is far from definite. The term "project" is variously used by different writers, even though the basal principle is clear enough. Projects may represent the work of an hour or of a year. Moreover, there are projects within projects. The idea is certainly good, especially in the vocational subjects and in general science. The technic for its realization is yet in the making.[2]

The first two implications of problematic learning have been given as the student's knowledge of the situation and its appeal to him, and have been provided for by the requirements that the problem shall be definitely understood by the student and shall be for him a real problem. With these requirements met there follows naturally his response to the situation, and with this the three remaining steps of thinking have to deal.

2. The Tentative Solution of the Problem.—The recognition of a problem and the feeling that it is of real significance leads one to undertake its solution. An unsolved problem is like an unbalanced force, which will not cease to act until it has come to equilibrium, either by realizing itself as action or by encountering an insurmountable obstacle. Thus it is that the high school student, when once he feels the challenge

[1] In reply, Professor Woodhull writes: "The whole movement is an attempt to introduce first of all a very specific organization where none now exists, and secondly a very different kind of organization from that hitherto attempted." In *School Science and Mathematics*, vol. XV, p. 229.

[2] In addition to the references already cited, the teacher may profitably read the article, "Project Science, Progressive," by J. C. Moore, in *School Science and Mathematics*, vol. XVI, p. 686, and chaps. XIII–XVIII of "The Teaching of Science," by J. F. Woodhull.

of a problem, will not rest until he has made at least an effort at its solution. He produces, therefore, at least a tentative solution or hypothesis, not always definitely formulated, often with no clear consciousness of what he is doing, but one which nevertheless serves as the point of departure and preliminary guiding principle in the quest of the desired solution.

Types of Hypothesis.—Naturally the form which the hypothesis or tentative solution takes follows directly from the form or type of the problem itself. If the latter be inductive, the hypothesis will be a generalization, in the form either of a class or of a general principle or law. As examples of the class-forming hypothesis we might recall the illustrations given earlier.[1] Such is the statement that in German all prepositions indicating direction of motion govern the dative, or that all crystals whose faces meet at a certain angle are salts from sulphuric acid. Whether correct or not can in these cases be determined only by subsequent observation, but in their present form they serve the purpose of working bases for further investigation. An illustration of the second type, for the establishment of a general principle or law, would be the hypothesis that the rate of vibration of the pendulum depends upon the length of the pendulum and the weight of the bob. As in the previous case, this hypothesis, although only partially correct, serves as the starting-point for the solution of the problem. In a similar way, the hypothesis in the deductive thinking consists merely in the solutions which the student believes will serve and upon the basis of which his further procedure depends. He attempts to explain the presence of deep parallel scratches on a flat stone and forms the hypothesis that they were caused by glacial action. When called upon to factor $x^2 - 289$, he forms the hypothesis that it is the difference of two squares and factorable accordingly. The determination of the motive in Macbeth's action starts with a hypothetical explanation as a basis, to be established or revised as the study proceeds.

[1] *Cf.* pp. 140 *ff.*

The essentials of a good hypothesis in instruction are fundamentally those of a good problem, since the hypothesis is but the logical sequent of the problem.

A first essential of the hypothesis is that it shall be a definite one in the student's mind. It must be one that, for the student, naturally and consciously presents itself as a solution of the problem, one that he himself suggests and formulates rather than one suggested or dictated to him by authority. Only when the initiative rests with the student will the principle of activity and self-reliance be realized. Many of the so-called hypotheses in poor teaching do not originate with the student at all, but are more or less incomplete tellings and dictations by the teacher or text-book, and arouse but little response from the pupil, for any well-trained schoolboy resents being told what he wanted to find out for himself. This does not necessarily imply that the hypothesis shall be formally stated by him, especially where the procedure is simple and obvious and a formal statement would hinder rather than further progress. On the other hand, where the procedure is at all complex and obscure and there is danger of losing one's bearings, a well-formulated statement of the hypothesis serves as a landmark in preventing wanderings and assisting the student to stay by his task.

The second requirement is that the hypothesis shall suggest, for the student at least, a real solution to the problem. Only when he offers a rational solution that appears adequate and not a mere guess will it be a real hypothesis and of educational value. With his limited experience and consequent want of judgment, his hypothesis will at best often prove inadequate and erroneous, and demand reconstruction. However, a goal to be sought in education is the ability to secure results with minimal expenditure of time and energy, and the high school boy should early be made to realize that he is responsible for results and that ill-grounded guesses seldom secure the results sought. Thus the formation of a hypothesis furnishes a training in judgment in the evaluation

of alternatives such as is afforded in few of the educational activities.

The teacher's function at this stage of problematic procedure is not passive, however. It might be said to be twofold. First, the teacher must by skilful development arouse the student to the formation and formulation of the hypothesis. Second, his previous training, experience, and study of the lesson and of the pupils should enable him to anticipate the guesses and solutions that will be suggested, and he should thus be prepared so to treat them as to guide them toward positive results. All this is a prominent element in skill in teaching, and involves a wise employment of encouraging, of insisting, of questioning, and even of suggesting and telling.

3. Reasoning Out the Implications of the Hypothesis.— The requirement that the hypothesis or tentative solution shall be rational carries with it the presumption that it shall be reasoned out, and that its implications be traced through in order to establish its validity. It is here that the real hard thinking of the problem is encountered. Here the principles of cause and effect, of essential and incidental, of similarity and difference are applied. Here occurs the interplay of induction and deduction, wherein generalizations are made, and applied in the explanation of the particular data of the problem. Imagination functions in that unseen causes and effects are ideally dealt with, since their actual employment is impossible or inconvenient, or the student, unable to try all of the suggested lines of action, selects which one to employ. He sees the reasonableness of his hypothesis that $x^2 - 289$ is the difference of two squares, since the second term, 289, ends in a 9, making it a potential square. In the case of the study of Macbeth's character, there would be times when Macbeth would still shrink from the crime when the danger of discovery was forgotten or when his moral objections were met. In the case of the pendulum, a change in size of bob alone or in length of cord alone would affect vibration rate.

Hypothesis Must Be the Student's Own.—A first requirement of the "reasoning out" step is that it shall originate with the student. It shall represent his own thinking, since borrowed reasoning ceases thereby to be thinking and becomes essentially memory material. As in the case of the problem formulation and the hypothetical solution, so in the case of the reasoning, the student initiative and activity must be preserved. No more here than in the preceding steps is the teacher to be a mere interested spectator, but, as before, his task consists in a skilful questioning, suggesting, and stimulating, so conducted that the student will with minimal expenditure of time and energy discover the implications of his hypothesis. Here again the teacher is confronted by the old problem, how far he should assist the student in his reasoning. Left wholly to himself, the student will infer wrongly, overlook essentials, and expend his efforts in almost valueless gropings for the truth. On the other hand, if the teacher assists too much, the student becomes dependent and loses the zest of the problem as such. It is herein that skill in instruction is employed, for the skilful teacher by watchful, intelligent, sympathetic observation will discover empirically the boundary between leading and carrying. In general, when the student reasons wrongly and the costliness of the error offsets the value of finding it out by results, the teacher should by questioning and in some cases by telling lead the pupil to see what would otherwise have been overlooked. The suggestions sometimes made that the student should never be told what he can find out for himself, and that he should be told when mistaken in order to save him waste of effort, are both extreme. The truth lies in a rational application of the principle of each.

Soundness of Hypothesis.—The second requirement of the "reasoning out" step is that it shall be sound. To permit a student to believe he is reasoning when in reality he is imagining or guessing is to stunt for him one of the highest, perhaps the highest, of his mental powers, for so long as he mistakes illogical for logical thinking he will never learn to

reason logically. Sound reasoning involves not merely valid reasoning but reasoning in a rational sequence. A demonstration in geometry may possess validity and yet at the same time be illogically organized. Moreover, it must be relevant, dealing really with the problem in hand. Too often students are disposed in the solution of a problem to say things about the problem which contribute nothing toward its solution, offering as justification the fact that what they said is true.

Sound reasoning is reasoning which is valid, sequent, and relevant, and none other should be accepted by the teacher. However, the first efforts of the student will usually fall far short of this ideal. His ignorance of the succeeding steps, his lack of perspective, and his want of training prevent perfect success at the first attempt. Hence, it is usually wise to go again over the argument, selecting, organizing, and polishing, so that when completed it affords him a measure of satisfaction and pride. The consciousness that a thing has been well done is a valuable incentive to doing other things well.

4. Verification of Hypothesis.—We have referred to the hypothesis as a tentative solution. It is therefore anticipatory in character, in that it represents a conclusion to be temporarily accepted until its validity or inadequacy can be established. The final stage of the complete act of thought is thus the verification of the hypothesis or tentative solution of the problem with which the thought concerns itself.

Material for the Verification.—The situation out of which the problem arises is essentially concrete, and the final test of the validity of the hypothesis is its workableness in the concrete. Thus verification, like the recognition and formulation of the problem, involves the observation of the concrete. However, the observation in the two cases differs in two essential features, its aim and its material. The aim of the observation in the first step is the formulation of the hypothesis, in the last step it is the testing of the hypothesis. The material of the observation in the first step is not a matter of choice, but is determined by the problematic situa-

tion itself; in the last step, that material is selected which most adequately represents the range of application of the hypothesis. The material is thus determined by the aim.

The material observed in the verification of the hypothesis is derived from two sources. In a large part of the curriculum, and especially in the humanities, it is an observation of already existent data or phenomena. In other cases, especially in the natural sciences and mathematics, it is made to order, supplied specifically in the form of experiment. As will be seen later, this element of observation occurs also in the laboratory mode of instruction, and, indeed, it would be difficult to draw any sharp line of demarcation between problematic and laboratory instruction. The laboratory mode may even be employed in the verification of the hypothesis formulated already in the problematic procedure or may, indeed, form a real part of the latter. The further treatment of this relation must be deferred until the laboratory mode has received some consideration.

Verification and Application.—Between the verification of the problematic procedure and the application mode of instruction, there is an at least seeming parallelism, in that in each case the abstraction or generalization of the problematic procedure is applied to a variety of concrete cases. The difference is thus not one of form, for in form the two are alike. The difference is rather one of *aim*, in that the verification is for the sake of reassurance that the hypothesis is sound, whereas the application presupposes the validity of the principle. The former is primarily for the sake of efficiency. With this relationship the chapter on the application mode will deal more fully.

Validity of Verification.—For positive certainty of the validity of the hypothesis or generalization, the verification is absolutely essential. One of the most valuable ends to be attained in high school instruction is the appreciation of certainty in knowledge, and a disposition to be satisfied without assurance when assurance is attainable is the mark of the

happy-go-lucky, a most undesirable trait in any individual's make-up.

However, complete verification is sometimes impossible, and when possible is occasionally unprofitable, especially for the high school student. The hypothesis that the scratches on the rock were caused by glacial action can never be proved although found to be extremely probable. The motive of the general in the campaign or of the character in the play are rarely positively declared but merely to be inferred. The verification of some of the laws as presented in elementary algebra is, for the high school student, valid only with positive integral exponents, yet the rule as formulated by him is treated as if of general validity. Although demonstrable deductively in higher mathematics, it is here capable of but an inductive inference based on a special type of cases. In secondary education most of the verifications are inductive rather than deductive in character, are based on observation of typical cases rather than on necessary relationships, and accordingly are valid only in so far as the cases selected for the verification are representative.

Thus the so-called proofs are often mere inferences, with a high degree of probability for their justification. The reasoning in not a little of the deductive verification of high school work is valid to the student only. Induction, even at its best, involves an inference from a few known cases to a multitude of unknown cases. Yet this does not imply that the student shall be taught to accept slipshod reasoning as final, or that the inference of induction shall be a leap in the dark. Rather, it means that the student shall be made to evaluate properly the product of his thinking. Although desiring positive certainty, he should when that is unattainable or unprofitable seek an approximation in the form of a probability, at the same time appreciating the degree of the probability. Though he must at times generalize with inadequate data, it need not be a rash generalization, and will not be if it was the best that could be done and is correctly

evaluated. He should learn, also, how to evaluate the premises or data from which he draws his conclusion, realizing that often even a single case may, by the principle of the uniformity of nature, furnish adequate basis for generalization.

Types of Verification.—Because the types of problem and of hypothesis in different studies vary widely, we find a corresponding variety in the types of verification. The factoring of $x^2 - 289$ is verified by a reversal of the operation, and multiplying together the two factors obtained in the solution of the problem. In both algebra and geometry a partial verification is often possible by the substitution of numerical values for the algebraic or linear values. In the case of geometry the student should be taught to see first if the conclusion claimed *appears* reasonable in the figure drawn, before attempting a more exact verification. The physics student who has formulated the law of the pendulum verifies the same by experimenting with variations of bob and of length. In a science like zoölogy or some parts of physical geography, where experiment is unavailable, recourse is had to observation of data which are intelligently and widely selected, including not only the cases that seem to confirm but also those that seem to discredit the hypothesis. In the study of history, the verification takes still different forms. Here the anticipatory judgment[1] looks for its justification to the facts related in the text or reference books, or even to the pupil's own experience.

Statement of Verification.—The definite statement or formulation of the verification usually offers two important advantages. First, it encourages greater clarity of thought in the verification. Careless language is frequently a mask for careless thought, and the necessity for justifying one's verification will induce an increased care in the reasoning. Clearer expression, better organization of thought, and more careful thinking will thus be encouraged. Second, the formal

[1] *Cf.* p. 141.

statement will afford opportunity for the correction of errors in reasoning and in concept. Not only the teacher but the class as well can scrutinize and, if necessary, correct the reasoning, thus securing for the pupil accuracy of thinking and correctness of solution of his problem.

Explanation.—Closely related to verification is explanation. Each is a review of a completed process of thought, but with a distinct aim. In the explanation all that is included is a recital of the successive steps in the solution of the problem and the purpose of each, whereas the verification has especially to do with the reasons for believing the solution to be correct. The former tells in a simplified form *what* was done and *why*, the latter is to show that the method was such as to realize the aim. "An explanation," says Professor Smith, "never attempts to state the reasons for, or causes of, scientific fact. . . . An explanation is simply a *description* which relates a thing or idea to other more familiar things or ideas. In this way we explain the hastening of the evolution of hydrogen, when a little cupric sulphate is added, by reference to what we know about electric couples. . . . The employment of terminology is not explanation."[1] These statements hold of explanations in general. Explanation of an algebraic solution of a problem in complex fractions consists in analyzing the solution into a series of simpler well-known processes, involving simple fractions and the fundamental operations.

The character of the explanation furnishes the basis for its function. When the method of solution of a problem is, as a method, worthy of special attention, often because it typifies a number of similar processes, it can best receive such attention by analysis into its component elements. It is just this analysis, this statement of the new and the complex in terms of the older and simpler, that constitutes explanation. When the pupil has solved the problem and is called upon to explain it, he and his hearers rethink the process of

[1] Smith and Hall, "The Teaching of Chemistry and Physics," p. 147.

the solution, thus impressing it more deeply, and because of the shorter time required in the explanation than that of the original solution, the whole is seen in better perspective and unity. The additional benefit derived by the student from the organization and expression of thought is also considerable.

What constitutes a good explanation? Taking the aim as basis for the evaluation, it would be such as most clearly and adequately brings out the process or relationship which the problem was primarily intended to realize. With a problem in factoring by inspection, the explanation would point out how familiar processes had been utilized in the solution; nothing more and nothing less than this. It would not involve an explanation of incidental and familiar processes, such as the subtraction of exponents or the removal of parentheses except in so far as these are specially and peculiarly concerned with the process of factoring. An explanation of a solution does not mean the relating of everything that has been done, but only what serves to explain the process for which the problem is intended. Evidently, merely reading what is written upon the board is not explaining, but the explanation should involve *rethinking* as well as *resaying*. Explanation of the self-evident is meaningless and absurd. Better understanding of its function and character would raise explanation from the mechanism so often given the name to the level of real educative activity on the part of the student, and incidentally result in a great economy of time and attention.

Verification and Proof.—The relation between verification and proof or demonstration is more immediate. As the term is commonly used, a proof or demonstration is logically practically the same as verification, and differs from it in being the *expression* of a verification for the sake of another party. The verification is involved in the problematic procedure and is completed when the observer himself has seen that his hypothesis is valid. Proof or demonstration consists in con-

verting that verification into language, as a means to its expression, so that the certainty may be shared by another. The student may be justly convinced that his problem has been correctly solved, but if he wishes to justify that conviction to others he must express that verification in terms of principles already accepted by the observer. For this reason many problems, in all fields of study, are wholly unsuited for demonstration, in that they are so self-evident that proof would be superfluous.

Teacher's Function in the Thought Problem.—In the foregoing paragraphs of this section the point of view taken has in the main been that of the student as learner. At the risk of repetition, it will perhaps be worth our while to trace through the teacher's part in the thought type of the problematic mode. Evidently his first efforts must be aimed at bringing to the student's consciousness the problematic character of the situation. He must induce the problem attitude. Merely telling a student that the situation is problematic avails nothing. He must be made to see and feel an intellectual need; the point of incompleteness in the system of his experience must cry out for remedy. Here the teacher may, by question and suggestion, bring the lack to consciousness by bringing the pupil to the point where his lack baffles progress in his thought, and challenges to solution. Then, as the problematic character of the situation is realized, further questions and suggestions must lead the student to the exact localization of the problem. The teacher must bring him not alone to realize the existence of something to be thought out, but also to run it down and isolate it for investigation. The known and the unknown must be clearly distinguished.

The attempt at a hypothesis must at first be a groping, but not necessarily a groping in the dark. The teacher, already knowing the situation, must throw the light upon the points to which he wishes his pupils to reach out. Naturally he can herein exercise a selective function. By ques-

tion and suggestion he leads the pupil to combine all the promising elements which the latter has found into a seemingly consistent and rational hypothesis. But young people are naturally impetuous, and prone to jump at conclusions. Incautiously they accept seeming solutions unchallenged. Here the teacher's best service may be that of restraint. He may do well to seemingly deny the hypothesis as formulated. At any rate, he must direct the student's attention to the necessity of looking into the implications of that hypothesis; to a sense of responsibility for it and a determination to be safe and assured.

Verification is the outcome of that determination. As at the outset of the problem he wanted to know its solution, so now his determination to know must culminate in the feeling that he *does* know; that he really has truth. But how is he to know? The teacher's service here seems to be primarily that of directing to ways and opportunities for trying out his supposed solution. His wider experience is at the student's disposal, to suggest possible situations where the hypothesis would be most likely to break down. Then, in turn, if it stands the test, to guide the student to recognition of its truth. If it fails (and false hypotheses are often good teaching material), he should guide to a reanalysis of the implication, a discovery of defects, and a corrected solution.

In the problematic mode the teacher guides the student into the mines of truth by going behind with the candle and admonishing his charge to keep within the circle of its illumination.

5. Application of the Problematic Mode in Teaching

Forms of Problematic Procedure.—Our previous sections have endeavored to show that whenever the knowledge of the new is sought in instruction, the problematic is the mode of development which is naturally involved. Attention was also called to the fact that, when a complete act of thought is

involved, problematic procedure falls into a fairly well-defined movement from knowledge of concrete facts through general conclusion upon these facts to the application of the generalizations to further concrete cases. Yet in the work of the class exercise the act of thought is very frequently incomplete. The development of an entire class hour may be employed in getting information, in deriving a general principle, or in verifying and applying a principle previously discovered.

Although the complete act of thought, involving all of its logical steps, is in some degree inherent in every study of the high school curriculum, the proportion between the different elements varies greatly in the different subjects. In the physical sciences and especially physics and chemistry, the discovery of general laws occupies a large amount of the student's attention. However, the verification is also common, so that here the circle of thought is exemplified perhaps as well as anywhere in the high school curriculum. Not only the informational problem occurs, but still more the thought type of problem, both inductive and deductive. In the biological sciences and agriculture, the informational and the deductive problems prevail, since the causal element upon which the general laws are based is so often inaccessible for the high school student.[1] Much of his discovery is of particular facts rather than of general principles, and a larger part of the remainder consists of the observation and verification of what another has already discovered and formulated. Possibly the most of the inductive work in this department of study is in the type study of zoölogy, wherein the student observes several members of a group in order to determine the common features of that group, and this type study is about the only form of laboratory work available in the high school course in biological sciences.

In mathematics, the information problem occurs but little if at all. The study is by its nature essentially one of necessary relationships, not of chance, and the thought problem is

[1] Lloyd and Bigelow, "The Teaching of Biology," p. 52.

the result. In the discovery and formulation of the general rules and principles the procedure is inductive, and in the verification of the principles and their application in the solution of the set exercises and problems the process is deductive. The direction so often met, "Teach by the inductive method," thus has a measure of truth, for merely to dictate rules authoritatively rather than to develop them with the class is to rob the student of probably the best thing in education, the zest of discovery and self-activity, and to render him a follower of authority instead of a seeker after truth. The working of examples is an essential and most helpful training, but does not of itself constitute mathematical training. If *all* of the mathematics is taught, the admonition to teach inductively as well as deductively will automatically be followed in so far as the subject occasions. Geometry has long been considered a peculiarly deductive science, a belief which seems to have originated in the emphasis formerly laid upon its demonstrative activities, and to have been self-perpetuating in that it has led to a continuance of the emphasis upon demonstration. When properly taught, geometrical reasoning begins farther back than the demonstration of the theorem, in an analysis of the conditions involved; then, by a synthetic procedure, the demonstration itself is constructed. "The classroom in geometry," says Professor Young, "is the place *par excellence* for the analytic method. . . . If the pupil is to be more than a passive learner, he must be shown the chain of reasoning by which the proofs given in the text might naturally have been discovered. Unless he catches the spirit of geometric analysis, he will never succeed in finding proofs himself." [1]

In the humanities the problems usually take forms quite different from those of the sciences. Naturally the quantitative element is of far less prominence. In the study of history the problems are often of considerable length and complexity, and require several class exercises for their solu-

[1] Young, "The Teaching of Mathematics," pp. 260–261.

tion. It therefore frequently happens that a single lesson may be predominantly informational in character, and the class not realize that they are at the same time securing data for the solution of a larger problem. Moreover, the number of generalizations which a high school student can formulate in the field of history is decidedly limited, so that a large part of the historical study in the school is a deductive interpretation of particular events and conditions in the light of principles already known, though often not clearly conscious in the student's mind. One of the most urgent needs of the history teaching of our schools is that the student, as well as the teacher, realize more constantly the problematic rather than the merely informational significance of the study, and the truth that historical facts merely as facts have very little educational value.

The problematic character of linguistic study has received much more attention during the past few years, since the inductive method of study has been employed in the text-books. True induction implies a necessary and causal relationship, and in linguistic study wherein many of the relations are arbitrary and the generalizations abound in exceptions, any induction is at best an approximation. Much of the material, therefore, must be given deductively and by authority, either through the text-book or by the teacher. However, the instructor should be on the watch for any opportunity for the student to derive general principles by inductive observation, and when the effort involved in the inductive generalization does not outweigh the benefit to be derived, should lead the student to the inductive discovery, thus securing for him the benefits which result from self-activity.

The study of literature has its learning and its feeling elements. The latter and its relation to the former form the basis for the following chapter. On the other hand, while the learning element in literary study has in it very little of the purely informational problem, the interpretation of a piece of literature furnishes thought problems in abundance.

Comparisons of literary style and motive, the grouping of writers and movements, the derivation of ethical principles are instances of inductive study. The interpretation of particular passages by means of the author's moral ideals and the tracing of philosophical and political influence in a book are forms of deduction. Whether the study of literature should always lead to an æsthetic or ethical outcome as its chief aim is a theoretical problem with which we are not here concerned. That its problematic character is an essential and most beneficial one is evident. High school music, as commonly taught, offers comparatively few problems, but consists mainly of training in appreciation with a considerable degree of drill upon already learned activities.

Vocational and applied subjects offer peculiar opportunities for the use of the problematic mode, due to the readiness with which real problematic situations can be found. The desire to produce a certain product, such as a bookcase, a loaf of bread, an apron, an inventory, or a business letter provides a well-motivated situation for its respective problem.

The rapid survey made in the preceding paragraphs will suffice to indicate the essentially problematic character of high school studies. The entire learning activity is thus seen to owe its origin to the student's desire to find out or to think out some problem which has arisen in the course of his study. The problem is the instigator of learning, and its solution determines the form and type of the learning. The four steps in problematic instruction are thus essential elements in every study which involves learning. Each study, however, has its distinctive type of problematic procedure, and accordingly fills a more or less unique place in the education of the school.

Transferrence of Acquired Efficiency.—This naturally raises again for us the problem of the transferrence of acquired efficiency. To what degree is the training developed in the various secondary school studies serviceable in other fields?

We saw in an earlier chapter (page 23) that the essential for such transferrence is a community of elements between the fields in question. What is there in common between the training in, let us say, algebra and physics? In both the thought type of the problematic mode prevails, in which the student is trained to a certain systematic mode of attack. In both subjects the problem attitude must lead to recognition of the problem, and so on through the series of steps in its solution. If in his algebra he is taught that the way to attack *any* problem is to do these things, that generalized principle of method will function in his physics as well, though of course much better if its applicability is pointed out to him. This is virtually the "scientific method," which we are told should come to every student of any science. In this he may be taught to assume the problem attitude of mind toward *any* situation, and to be dissatisfied with a solution that is not convincing when subjected to scrutiny. He *may* be taught these things. Too often he *is not*, because the general applicability of the principle involved, the community of elements between the various situations, is not brought to his notice. In the latter case he learns algebra perhaps, but algebra only.

A somewhat similar condition holds in those studies or parts of studies in which the problematic mode is of the information type. Children may simply be told to look in certain places for desired information. Such direction has no further educative value. If, however, they are taught to be self-reliant in the quest for information of whatever sort, and to utilize all the available sources, this training can be made to function widely. What was said in the last paragraph about the problem attitude is equally applicable here.

In the case of the training of observation the case is somewhat different. Observation necessarily involves some familiarity with the thing to be observed. It is doubtful whether the student who has never studied natural science would be very observing of chemical phenomena in the way in which

the chemist uses the term. Content functions largely here, as an "apperceptive mass." In chemistry and physics the content is somewhat similar, and observation trained in one may function somewhat in the other.

To trace through the application of the principle to the various studies of the curriculum and to the many elements of training is not within the scope of this volume. The lesson for us seems to be that transferable training is not inherent in subjects as such, but in the discovery of and generalization upon common elements in the various types of study and of life activity. There must be not simple associations alone but associations after disjunction.

The three general rules outlined in Chapter II were these. The derivation of concepts should be made from a wide variety of cases, the meaning rather than the form should be made the basis of connections, and the principles or processes should be given a wide variety of applications. Of these, the first two have been incorporated in the thought of the entire present chapter. The third will find its place in Chapter X.

"Our pupils do not think" is the frequent complaint of high school teachers. Doubtless the basis for this condition lies in the fact that students are not trained to be sensitive to the problems that confront them. They are seeking knowledge, not questions, and do not realize that questions are the means to knowledge. It is peculiarly the opportunity of the problematic mode of instruction to develop this sensitivity to problems, and to lead the student from the attitude of acceptance of ready-made ideas to the problem attitude of the seeker after truth, the challenger of experience.

Place of the Problematic Mode in the Class Exercise.—The significance of the problematic mode as a type of instruction has been indicated. How and where shall it enter into the class exercise? The propædeutic function of the recitation mode, as treated in Chapter VI, was based upon the fact that when properly selected it served to provide the back-

ground out of which the desire for further knowledge arose, and to revive the already known data which might serve in the quest for that desired further knowledge. The problematic development consists in taking a situation which is familiar in most respects but which presents one phase demanding investigation, and leading on the student to the solution of the problem thus involved. Evidently, then, the problematic mode naturally begins where the recitation leaves off, and takes its origin to a considerable degree in the recitation period. The class exercise thus starts naturally with the recitation procedure, and, often with no sharp line of demarcation, gives way to problematic procedure as the problematic element emerges from the material of the recitation. It is thus that the principle of lesson development, "proceed from the known to the unknown," finds its application.

Can the problematic procedure be profitably employed as the sole element of the class exercise? Two considerations point to a negative answer. Procedure from the known to the unknown suggests the necessity of a recitation upon familiar material in order to create the situation out of which the problem arises. To plunge abruptly into a problem without some degree of introductory thought is to violate the principle just referred to, and at the same time is contrary to the way in which problems actually arise outside of the school. A second objection to such procedure is the failure to provide for the factor of expression and application, the importance of which has already been mentioned, and which will occupy our attention later.

6. Summary

Problems in instruction are of three kinds—informational, inductive, and deductive—or are formed by the synthesis of these elements.

Information reaches the student from either of three sources. (i) Telling, especially by the teacher, (ii) reading,

principally from text-book and reference books, and (iii) observation and experience of the student.

Problematic procedure involves four steps: (i) recognition and formulation of the problem, (ii) a tentative solution, (iii) reasoning out its implications, and (iv) verification. The first of these calls for definite understanding of the problem, whether informational, inductive, or deductive. The problem must be a real one for the student. The tentative solution or hypothesis must be for the student definitely understood and adequate as a hypothesis. The implications shall be reasoned out by the student rather than for him, and the reasoning shall appeal to him as sound. The verification shall be, for him at least, conclusive. Verification must be differentiated from both explanation and demonstration. The teacher's function is to stimulate to zeal for knowledge and to soundness of thinking.

The problematic mode is applicable to nearly all the studies in the high school curriculum, especially to mathematics and the natural sciences. The basis for the informational problem is simple association; for the thought problem it is association after dissociation, with an analysis-synthesis-analysis-synthesis[1] movement. Transferrence of acquired power is possible in the case of problematic learning in so far as community of elements is made obvious and generalizations drawn.

QUESTIONS FOR DISCUSSION

1. Can you suggest any content of secondary school instruction other than appreciation material that cannot be advantageously cast in problem form?

2. Is there a tendency for undeveloped content (*cf.* Chapter VII, Question 2) to assume the form of the finding-out problem, when it properly should take the form of a thought problem? Justify your answer.

3. Is the good text-book the one that tells the most? What should a text-book tell? What should it leave untold?

[1] *Cf.* p. 139.

4. Suggest several thought problems from the secondary school subject which you propose to teach. Point out in each the four steps in the complete act of thought.

5. From the same study, suggest several purely inductive problems; several purely deductive problems.

6. Suggest thought problems which are so simple that the student is not conscious of taking the four steps involved.

7. Are all problems equally "real" to all members of the class?

8. Suggest a "project" from the field of your specialty, and indicate how it might be attacked.

9. If a student suggests a false hypothesis, under what conditions would you permit him to push it through to the verification step, without calling attention to its falsity?

10. Does it destroy the pupil's confidence in his method when he is shown that his supposed verification is really only a partial one, though acceptable for present needs?

11. Are the teacher's and the pupil's explanation parallel in form? If not, wherein do they differ? Why?

12. How far can training in geometric reasoning be made to serve in chemical reasoning?

13. Select some thought problem, and show how it involves the principle of association after dissociation.

SUPPLEMENTARY READINGS

De Garmo, "Principles of Secondary Education, Processes of Instruction," chaps. I, II.
De Garmo, "Interest and Education," chap. XII.
Dewey, "How We Think," chaps. VI, VII, XIV.
Thorndike, "Principles of Teaching," chap. X.
Strayer, "Brief Course in the Teaching Process," chaps. V, VI.
Parker, "Methods of Teaching in High Schools," chap. IX.
Colvin, "An Introduction to High School Teaching," chap. XIV.
Bolton, "Principles of Education," chap. XXIV.
Henry, "The Problem Method in Teaching," in *School and Home Education*, February, 1917.
Wilson, "The Problem Attack in Teaching," in *Elementary School Journal*, June, 1917.
Rosenberger, "The Problem Method in Teaching History," in *Normal Instructor and Primary Plans*, November, 1916.
Woodhull, "The Teaching of Science."

CHAPTER IX

THE APPRECIATION MODE

1. Character and Function

Meaning of Sentiment.—Following the student's knowledge of a new situation with its appeal to him comes his response to it. When that response is predominantly intellectual, the situation is to that degree an intellectual one and the problematic mode of instruction is employed in the lesson development. However, in many cases and especially in humanistic studies, the response has in it something more than mere knowledge or discovery of truth. When I read a poem, contemplate a landscape, study an animal form, or even follow a geometrical demonstration, the response may be more than the merely intellectual one of knowing and of finding out, which in some cases may be comparatively negligible. I admire the form and style of the poem, the symmetry and color of the landscape, the wonderful adaptation in the animal life, the directness and simplicity of the demonstration. In other words, I form in each of these cases a critical judgment, pronouncing the object of study beautiful or true. This critical attitude, combined with the stronger feeling element, the satisfaction or dissatisfaction which accompanies it, is what is known as sentiment,[1] and forms the basis of the situation response which we call appreciation. To appreciate a thing, therefore, means to experience this sentimental response to it.

Sentiment is more than mere emotion, though the terms are often used interchangeably. Emotion is a complete sur-

[1] For a more adequate treatment of sentiment the reader is referred to Titchener's "Text Book of Psychology," pp. 499 *ff.*

render to the situation, uncritical and unreserved. Sentiment usually involves less intense feeling, and is deliberative, calling for an exercise of judgment. We do not only experience the gratification which comes from the mere reading or contemplation, losing ourselves in it. We do not, as in emotion, merely feel *because of* its beauty or truth, but we feel *that* it is beautiful or true. Emotion in its lower forms is not of educational value. It is only with its development into sentiment, involving intelligent judgment and its attendant feeling, that the work of instruction concerns itself, in what we have called the appreciation mode.

Aim of Appreciation Instruction.—What is the aim of appreciation instruction? To say that it is to make the student feel is evidently not enough. In sentiment, the feeling necessarily accompanies a judgment. When we judge a given situation to be beautiful or good or true, the judgment has a strong feeling tone; it is decidedly pleasant. We say that we appreciate it. To train the student thus to respond, to correctly judge and to judge feelingly, is what appreciation instruction seeks to accomplish.

How can we know that the judgment upon which the student's appreciation is based is correct? What constitutes this correctness of judgment? It is here that the personal factor enters. In matters of fact, such as dominate the problematic mode, correctness implies agreement with an externally determined situation. Either the stone falls sixteen feet in one second or it does not. Either the battle of Gettysburg occurred in 1863 or it did not. Thus, the student's personal attitude toward the situation is to be ignored in the judgment of facts. In the case of appreciation it is fundamentally different. Here the judgment is not one of fact but one of value. The very essence of sentiment is the personal character of the response. The present-day theory of sentiment, known as the doctrine of empathy, is that our responses to situations are determined by the injection of ourselves into them, the interpreting of them in terms of our own

experience and feeling. It follows from this that no two persons will derive the same sentimental experience from a given situation, for the critical judgment is in terms of the person's own self, with its individual experiences and feeling attitudes.

Appreciation instruction is not for the purpose of substituting for the student's sentiment the sentiment of author, or artist, or even of teacher. Sentimental responses are not given, but arise from situations, and any attempt to dictate a sentimental response thwarts its own end by depriving it of its fundamental personal character. However, in the study of a work of art, such as a painting, poem, or novel, much of the artist's skill consists in presenting the situation not merely as it is, photograph-like, but as he sees it and experiences it, colored by his own response to it. In such cases it is but natural that in the main the student's response should be similar to that of the artist or author. Thus there is a unity of response between student and author, and the former is inspired to rise toward if not to the level of the author's experience, with all the æsthetic and ethical benefit to be derived from so doing. At the same time, the filling in of the detail out of the student's own life experience and personality serves to make the whole really his own, even though at a higher level than he could have attained independently.

Can appreciation be taught? The question has received various answers, either frankly stated or more or less clearly implied. The literary man, thinking perhaps of instruction as a mechanical inpouring of information, declares that appreciation cannot be taught. The writer on education, perhaps because he realizes the difficulty, perhaps because his attention is given more to the intellectual aspects of study, has little or nothing to say on the subject. The writer feels that here, as elsewhere, method can be employed, but that here, as elsewhere, the determining factor in instruction is the student's own activity, and that with intelligent, sympathetic procedure appreciation can be secured even though the procedure be difficult and exacting. Appreciation as a

fixed response to a given situation is impossible, for its essence is its spontaneity. However, there is every reason why the teacher should lead the student to a better, richer understanding and interpretation of the situation, and to a response thereto, whether that response be intellectual or sentimental or both. It is in this sense of the term that appreciation can be taught.

2. Types and Forms of Appreciation

The Three Types.—Appreciation as a factor in secondary school instruction naturally falls into three types, following the three traditional types of sentiment: the intellectual, the æsthetic, and the ethical. Consciously or unconsciously, our critical judgment is in terms of the true, the beautiful, and the good, even though sharp lines of distinction between these are hard to draw and are for our purpose unessential. A given situation may appeal to us because of both its truth and its beauty. The story may attract us because we realize that it is true to life, harmonious in its thought, and inspiring to moral conduct. Instruction may lead the student to so interpret the situation as to discover and feel its truth, its beauty, its ethical character.

Appreciation in the High School Curriculum.—With the increasing recognition of the fact that much of the content of the high school curriculum has but little practical knowledge value, there has grown up a disposition to discover as its supplement an appreciation value. Teachers of mathematics, science, and history are advocating the study of their respective subjects for the sake of the sentiment therein contained, thus sharing with literary study in the appreciation aim, though the place assigned it is necessarily subordinate.[1]

[1] Young, "The Teaching of Mathematics," pp. 43–44; Lloyd and Bigelow, "The Teaching of Biology," pp. 253 *ff.*; Bourne, "The Teaching of History," pp. 99 *ff.*; Smith and Hall, "The Teaching of Physics and Chemistry," pp. 12–13.

Students are to be taught not merely to *know* the truth but to love it as truth; not merely to know about beautiful things but to see and feel the beauty in them.

Naturally the secondary school subject in which appreciation is the prominent and even the primary aim is the study of literature. Literature has long been viewed as the appreciation subject *par excellence*, and our study of the principles of appreciation will necessarily have peculiar reference to it. With it, the sentiment is the chief element in the student's response, for its situations are essentially sentimental in character. Accordingly the appreciation mode of instruction will be for it the prevailing mode, though applicable in the other fields of learning in so far as sentimental as well as intellectual response is sought. The study of English composition is a helpful means to the training of appreciation in that the understanding of technic involved renders the æsthetic judgment of literature more intelligent and sensitive. At the same time it stimulates and cultivates the imagination, thereby rendering sympathy with the imaginative in literature the more possible.

3. Procedure in the Appreciation Mode

The sentimental response is largely determined by the situation which occasions it. It is no violation of the principles of the foregoing paragraphs to say that the method of securing any type of response is to present to the individual a situation such as will induce in him the response in question. This is the foundation stone of the appreciation mode of instruction.

The essential in instruction, in appreciation mode as well as in problematic, is the inciting of the student's self-activity. The task of the instructor is so to develop the situation that the students will respond in the best way and to the best degree, and it is in the ability so to develop situations that the success of the teacher of literature largely consists. The fol-

lowing suggestions for appreciation instruction are but statements of the principles which hold in this development.

1. **Appreciation by the Teacher.**—The teacher must himself catch the spirit of the situation. He must be full of it; so full that he feels an eagerness to share it with others in whom he is interested. The importance of this lies partly in the fact that only under these conditions can he himself appreciate deeply and catch the force of the situation. If he seeks æsthetic appreciation, he must himself be alive to the beauty he would bring to the class. If he wishes to impress his pupils with the exactness of scientific truth, or with the moral lesson of an event in history or fiction, he must himself feel as well as recognize these qualities. Moreover, the mood of the teacher is largely determinative of the mood of the class, and the mood with which a class meet an appreciation situation affects greatly the response to that situation. For the teacher of an appreciation subject, such as literature, a personal relation of sympathy and friendliness between teacher and class both in and out of the classroom is in a peculiar way an invaluable asset for the securing of effects in the class instruction.

2. **Realness of Situation.**—A vital, perhaps the most vital, requirement is that the appreciation situation shall be made as real and vivid to the class as possible. The poem of "Enoch Arden" can best be studied when the students have in imagination seen the background and the characters of the story and the scenes enacted; and the childhood games and youthful interest of Annie, Philip, and Enoch are their own lives reconstructed in the new setting. An appeal to the student's own experience will both facilitate the arousal of the response to the new situation and deepen the impression made, involving a comparison and providing the basis for a generalization when one is sought. Especially for the high school student it is well first to paint the sensory imagery, calling attention to the images of sight, sound, and movement in so far as the nature of the subject permits. Pictures are here of value

when well selected and wisely used. They need not be pictures intended for the purpose; indeed, such pictures often leave too little for the spontaneity of the student's imagination. The students may profitably be called upon to bring to the class such pictures as seem to them to suggest the thought of the passage under consideration. The picture must, however, be used with discretion, since unessential and even negative elements may become prominent but undesirable components of the student's mental picture.

In productive work, such as English composition, the same principle holds. One reason that the essays and stories of school students are so often mechanical and weak is the lack of vividness of imagery with which the work is undertaken. Just as pictures help the elementary pupil to see the thing he is to write about, so in the high school a story or word-picture demands vividness and realness in the student's mind before any worthy production can be forthcoming.

The suggestion that the imagery be real and vivid carries with it a corresponding danger. Realness and vividness must not be confused with completeness of detail. The object sought in this case is not information but suggestion, and the picture showing detail often indicates too much to the imagination of the student. This holds not alone of the printed picture but of the word-picture as well. If it is to be the pupil's own response, one in which the personal factor is to function, the best picture is that in general terms and broad outlines, the remainder being left for the imagination of the pupil to fill in. Appreciation situations cannot and should not mean the same or elicit the same response with different persons, and the instructor who even unwittingly forces upon the class his own interpretation robs the class of that for which the lesson is intended. Sentimentally as well as intellectually it is a violation of the principle of student self-activity.

After the sensory imagery of the situation has been secured, the idealized and abstract imagination should also be developed. Little if any of the appreciation material studied in

the high school is solely for the sake of the sensory imagery, but should lead ultimately to appreciation of the higher order. It is in this final stage that the student is ready to take home to himself the deeper sentimental significance of the situation. With the background properly painted and the appropriate atmosphere created, the central features of the picture, for which the other imagery was preparatory, can be filled in with the best and most lasting effect. Using again the illustration of "Enoch Arden," the moral conflict and ultimate victory of Enoch are made more significant to the student after its setting has been realized.

In securing this imagery the student must not be a passive listener or reader. He must supplement from his own imagination, and must help in the painting of the picture or the creation of the situation. Reading aloud by the student of the passage studied is often a means for securing this contribution in that the reading enables the student to in part paint the picture himself. It need hardly be added that the only reading in which this is accomplished is that in which the student really makes the reading a conveyor of content and interpretation, instead of being the halting, expressionless performance so often tolerated even in the high school class in English.[1] A later reading by the teacher, especially if ably done, will assist in the interpretation by giving another, presumably a more adequate, rendering.

3. **Familiarity with Medium of Expression.**—Closely related to the last-named requirement is the further one that the student be familiar with the medium of expression, including the facts, the peculiar idioms and words, and the allusions employed by the author in the selection studied. In other words, the student must have an adequate "apperceptive mass" before the lesson can be mastered. In literature, and especially in poetry, the medium of expression includes also such factors as literary style, rhythm, and rhyme. Of these, the rhythm and rhyme contribute to æsthetic feeling in a

[1] *Cf.* Colvin, "The Learning Process," p. 125.

more mechanical way, and are the easier to study, while the appeal of literary style is of a higher and more subtle type.[1] In much the same way, the study of technic of the expression of thought and feeling renders the expression more effectual, as well as capacitates the student for the appreciation of good expression by others.

It is here that the study element of appreciation enters, for a goodly part of literary study consists in an examination of medium of expression, without which interpretation would be impossible. The enthusiastic teacher, eager to secure the appreciation element of the lesson, is often tempted to overlook this, the foundation of the interpretation. Rather than fail to insure this foundation, the teacher should, before seeking to secure the appreciation, question the class in order to make sure that the medium of its expression is clear, as well as to revive in consciousness the data which render the appreciation possible. This suggests to us the much-debated question whether the class should undertake the analytic study of a literary selection for the first time in the same class exercise in which the appreciation is undertaken, or as a home assignment in preparation for the appreciation class exercise. Possibly the best plan is to follow the former procedure when the language or content is readily understood, and the latter when a considerable degree of study is a prerequisite for the appreciation.

But the study of these things is not a study of literature or literary creation. It is not the end but the means to the end, and the too common practice of permitting instruction in literature to degenerate into a study of its medium tends rather to give the student the notion that literature is merely language. It is like pulling the flower to pieces in quest of its beauty, or looking at the telescope instead of looking through it. "Let the English teacher teach the life that lies beneath the word, and there will be no more occasion to

[1] *Cf.* Judd, "Psychology of High School Subjects," pp. 184, 194.

complain of a lack of æsthetic appreciation."[1] The author, like the public speaker or reader, seeks to secure a response as directly as possible, and the less attention is required by the medium of expression, the more adequate is the expression. Excess of detail in appreciation instruction prevents rather than furthers appreciation. Carried over into another field, this criticism applies with equal force to the effort to make the student of Vergil appreciate the beauty of his style when his unfamiliarity with the language limits his attention to the mechanical aspects of his labored translation. He merely sees words and phrases, with no opportunity for feeling. Moreover, even when appreciation is really possible and sought after, it is not necessary, because of our respect for thoroughness, to fall into pedantry, and imagine that the student must know *everything* about everything in the selection. The ability to evaluate correctly is a quality of mind invaluable to the teacher of literature.

4. Understanding of Thought.—Higher than the consideration of imagery and of medium of expression stands the study of the thought itself. Not merely, how does the author say it, but, what does he say? To simply follow the story of a narrative, whether in literature or in history, and to treat it as merely a series of events is to miss utterly the aim for which its study is intended. Knowledge of how to demonstrate a proposition and to trace the effect of environment on plant life is not all that geometry and botany should produce. Back of these events and processes lies a higher meaning, a truth or beauty, moral or intellectual or æsthetic, which gives them value, and in so far as adapted to the maturity of the student, this meaning must be discovered. The student in the literature class who gets merely the "run of the story" is not studying literature.

To a greater or less degree, there must be an analysis of the content, and the points obvious enough for the teacher

[1] M. Catherine Mahy, in "Æsthetic Appreciation of Literature in Secondary Education," *School Review*, December, 1907.

must be so illuminated as to stand out for the pupil's notice. In almost all of the material studied in the high school, not excluding literature, there is an aim broader than the understanding and appreciation of the particular point or selection. Merely the ability to appreciate "In Memoriam" is not the justification for its study. Rather, it is treated as a type of literary production; the others similar to it cannot all be considered in the classroom or school, but the ability and disposition to read them later are to be trained. Recalling our discussion of formal training,[1] we recognize the necessity of dwelling not upon the particular features but the broader meaning of the selection, its ideas and generalizations, and it is of the development of these that the highest form of literary analysis must consist.

The degree to which such analytic study of literature should be carried naturally depends on many factors, such as the maturity of the class, their previous literary training, and the character of the content. That it should extend to an understanding of the general plan of the selection is self-evident. That excessive analysis distracts attention and deadens appreciation is equally evident. It involves a further danger of reading into a passage a meaning which is not intended and which detracts from rather than furthers the student's personal reaction. Quoting from Professor Baker: "One general principle seems to me to cover all such study: the analysis that reveals to the pupil new meanings within his power of comprehension, and new beauties within his power of appreciation, while keeping true to the spirit and tenor of the literature as it is known to scholars—such analysis is not only safe but of the very essence of good teaching."[2] Substituting the word "subject" for "literature" in the quotation, the principle is equally valid in every department of study whenever appreciation is sought as either primary or secondary aim.

[1] *Cf.* p. 24.

[2] *Cf.* Carpenter, Baker, and Scott, "The Teaching of English," p. 281.

5. Appeal of Situation.—The appreciation situation must be of a sort to really *act* on the student—such that he will react to it. One of the prime considerations in the selection of material for the class in literature is the appeal which it will make to the student, and that whose intellectual or sentimental plane transcends the reach of the high school pupil has no place in the secondary school curriculum. In the same way, the appreciation of the beauty or truth of a scientific principle or process may be possible only for the trained adult, and quite meaningless for the inexperienced youth. But, granting the appropriateness of the content, its presentation to the pupil is equally important. The teacher must, by discussion, exposition, and questioning, lead the student to a real reaction. The sentimental element must be made subjective and personal. The student must, consciously or perhaps unconsciously, ask himself the question, What do *I* think, how do *I* feel in this matter? Without this, it is not appreciation but examination, not studying literature but studying about it. The situation must be brought home to the student as his own experience. He must feel that the mathematical demonstration, the scientific truth, the moral lesson, or the sentiment in his composition, is really his, and that he has made it his either by discovering or by adopting it. Otherwise his attitude will be merely intellectual and not appreciative. One of the chief purposes in literary study is to secure sympathetic feeling, yet this can never be accomplished without the personal response in the face of the situation. The pupil is to be led to relive the experience of the author; not actually, it is true, but ideally. The effect upon character-development of thus ideally living the experiences of noble souls, in sharing in a measure their emotions and impulses, of feeling as *they* felt, is more than one might imagine. The sharing of worthy motives and decisions, even in imagination, has a positive moral-training value too great to be neglected.

Possibly the most baneful influence in appreciation proce-

dure is that of pettiness. The appeal to the student is based on the worth of the object of appreciation, and when a teacher expresses enthusiasm over that which to the student is unworthy or trifling, the mood of disgust aroused will prove fatal for the subsequent appreciation even of the worthy. In the same way, the teacher who "gushes" over a literary selection, whose effort to induce the student's enthusiasm takes the form of a mere declaration that the selection is worthy, does not thereby lead the thoughtful student to the same enthusiasm. "Isn't that beautiful!" "Don't you think this a beautiful passage?" and "You can't help admiring Enoch Arden, can you?" will lead to no valuable results unless the student sees for himself that the teacher's declarations are justified, and in the latter case they are often superfluous. Omit the intelligent basis for appreciation and it becomes mere emotion.

6. Classroom Atmosphere.—The atmosphere of the classroom doubtless plays a larger part in the appreciation mode than in any other form of instruction. Control of sentiment is far more difficult than control of thought, and conditions in the midst of which the student could force himself to intellectual activity may well be such as to preclude sentimental appreciation. To the securing of a favorable mood, the whole environment contributes in greater or less degree and in various ways. The tempo of the class exercise is especially important. While in general the tempo in appreciation instruction should be somewhat slow, possibly because time is required for ideas to arouse their sentimental response, the movement must after all be determined by the thought, not merely expressed but unexpressed as well. Interruptions in appreciation are especially to be avoided, partly because of the impatience of mood occasioned, still more because feeling follows directly from situations, and when interrupted is very likely to be lost or at least weakened and altered as a result.

4. Summary

Sentiment, upon which appreciation is based, cannot be directly imparted by instruction, but can be induced by the supplying of suitable situations.

Appreciation, like sentiment, is either intellectual, æsthetic, or ethical.

The conditions essential to appreciation instruction are a sympathetic instructor, a real situation, a familiar medium of expression, an understanding of the thought, a situation which appeals to the student, and a favorable classroom atmosphere.

QUESTIONS FOR DISCUSSION

1. In general, judgment is based upon knowledge and experience. For example, judgments of distance, of value, and of methods of procedure. Is this true of the judgments upon which sentiment is based? What does your answer imply as regards the possibility of teaching pupils to appreciate?

2. Will training in the appreciation of poetry facilitate the appreciation of prose? Of painting? Justify your answer. Suggest implications of your answer.

3. As ordinarily taught, does the study of geometry develop intellectual or logical appreciation? Suggest how it should be taught in order to do so.

4. What type or types of appreciation should the study of botany develop?

5. Suggest ways in which the teacher of literature may increasingly "catch the spirit of the situation" upon which the appreciation lesson is to be based.

6. Is a strong power of imagination essential for the successful student of literature?

7. In the appreciation element in English composition, just what does the student appreciate? His own thought and style? The object of which he writes? Thus, in describing a landscape, which does he appreciate: the landscape or his description of it?

8. What types of appreciation have most appeal for high school boys? For high school girls? Can you suggest an explanation for these differences?

SUPPLEMENTARY READINGS

Titchener, "Textbook of Psychology," pp. 498–503.
Strayer, "Brief Course in the Teaching Process," chap. VII.
Parker, "Methods of Teaching in High Schools," chap. X.
Judd, "Psychology of High School Subjects," chap. IX.
Gerson, "Appreciation: An Educational Aim," in *Current Education*, September, 1916.
Carpenter, Baker, and Scott, "The Teaching of English in the Elementary and the Secondary School," pp. 278–281.
Arlo Bates, "Talks on the Teaching of Literature," especially chap. VIII.
Bolenius, "Teaching Literature in Grammar Grades and High School."
Thomas, "The Teaching of English in the Secondary School."

CHAPTER X

THE EXPRESSION-APPLICATION MODE

1. Character and Function

One need not be a pragmatist to realize that the learning and feeling of the school instruction should lead to something beyond learning and feeling. It is in this uniting of intellect, feeling, and action as three phases of a single process that the formation of both moral and intellectual character consists. "No impression without expression" is an old pedagogical maxim which recognizes this principle. The generally accepted fact that only usable knowledge is true knowledge expresses much the same thought.

Meaning of Expression and Application.—In the development procedure, both problematic and appreciation, the student is responding to a situation which confronts him and appeals to him. In both modes of development the student's aim is in terms of the response itself, and takes no account of anything beyond it and resulting from it. The thinking and feeling are solely for the sake of the thinking and the feeling. However, when this response has been aroused there follows the further step, the expression-application procedure, which aims at the extension of the process beyond the bounds of the person or field in which it originated. The student desires to extend his thought and feeling to persons other than himself, and his power to cases other than that from which it arose. Thus we have the expression and the application as two phases of the expansion and extension of the intellectual and sentimental processes, with the expression laying emphasis on the *formulation* of the thought or feeling, and the application on its *use*.

Educational Value.—Possibly the expression and application provide the chief ethical and social values of the class exercise. The essence of moral and social training lies in the ability and the disposition to employ the feeling and intellectual products for the accomplishment of further results. So long as teaching stops with knowledge and feeling, culture will be selfish and formal. Only when the student has the ability and the disposition to share his experience and to use his knowledge will the broader function of education be realized. The expression of a sentiment usually carries with it an ethical momentum, in that it commits the individual to its realization in conduct. A sentiment which does not have bound to it some form of expression is not educative but harmful, both individually and socially, for it induces selfishness and deprives society of the service which the expression of helpful sentiment induces.

It must not be supposed, however, that sentiment alone is to be expressed or knowledge alone applied. What really happens is that both are first expressed and then applied in so far as the nature of each allows of that expression and application. The expressing and the applying are so closely related in character that a sharp line of separation cannot be drawn, the same activity often serving as both expression and application at the same time. In form, if not in aim, expression often involves application, just as application may be viewed as a kind of expression.

Apart from the social and ethical implications of the expression-application instruction, there are several considerations to be observed in judging of its function and value. From the teacher's standpoint, the expression and application serve as possibly the best test of the efficacy of the instruction. The method factor of testing is thus applied in the expression-application mode, though to a less degree and in a more limited way than in the recitation mode. If the student can tell adequately what he has learned and can use it readily and accurately, it is safe to infer that the learning

was adequate. It is too easy to assume that when the class seem to understand and appreciate the lesson, the instruction process has attained its goal, and the ability to tell or use is taken for granted.

A further value to the student of expressing his thought and feeling lies in the fact that the act of expression involves the formulation, which adds much to the definiteness and depth of impression. Before he can accomplish much in the way of expression he must bring his impression to consciousness and organize and evaluate his thought. From the standpoint of linguistic training, oral expression may serve, as Professor Dewey has said, to enlarge the pupil's vocabulary, render its terms more precise and accurate, and form habits of consecutive discourse. So, too, the application or using of his knowledge in the accomplishment of his purpose provides the flesh and blood, the vitalizing element, without which its significance would be lost. The knowledge acquired in the class exercise is at best of an outline character, due in part to the limitations of the student's experience, and needs the filling in which only a broader use and application can supply.

A still further value lies in the skill which comes with the use of an acquired process or capacity. As knowledge should lead to action, so it should be rendered usable through practice. One of the most frequent complaints against much of our high school education is that, although the graduate knows many things, he cannot use that knowledge or do the things which such knowledge should fit him to do. As at present organized, the typical secondary education offers far less training for "knowing how" than for "knowing things" or "knowing about" them. The element of efficiency should be a fundamental one in learning.

2. Forms of Expression and Application

The line of distinction between expression and application is, as we have seen, not sharply drawn. Not merely may the

same process serve both functions, as expression and as application, but even the two functions are not always distinct. The boy writing an essay is at the same time expressing his thought and feeling and applying his knowledge of the principles of English composition. There are, however, certain typical forms of expression and of application, a study of which will assist in bringing to the teacher's consciousness the function and consequent essentials of the expression and application procedure in secondary instruction.

Forms of Expression.—Opportunity for student expression occurs constantly in both recitation and development. Whenever the student tells what he knows or thinks or how he feels, the activity is one of expression. The restatement of a rule formulated by the class, the description of an event learned of in his home study or witnessed by himself, the explanation of a problem which he has solved, and the passing of a judgment concerning social, moral, or æsthetic values, all these are but instances of the many forms of student expression common in all secondary instruction. The answer to a question or even the formulation of a question is usually the expression either of an idea or of the consciousness of a need. Viewed in this way, the method factor of expression permeates the entire student activity, and occurs throughout the whole class exercise, including both lesson development and recitation.

One of the essential functions of the study of English composition is that of the expression of the student's thought and feeling, a function too often subordinated to its other function, that of application. What can be more deadening for thought than the all too common attitude of viewing the composition work as essentially and primarily a formal drill in the application of linguistic and rhetorical rules, rendering the study formal in the extreme? The fact that language is essentially a medium for the expression of ideas and feelings is being more and more recognized in modern study, as is shown in the fact that the cultivation of ideas as the basis for Eng-

lish composition is gaining an ever larger place in linguistic study. The expression element in literary study finds an excellent opportunity in the attention given to more adequate oral reading, and in the occasional dramatization of appropriate pieces of literature. Indeed, sympathetic listening to good reading and observing of able dramatization may to no small degree serve the same end.

Forms of Application.—The forms of application are quite as various as are those of expression, and appear almost as frequently in instruction. Moreover, application is frequently much more complex in character, and accordingly many of its forms occupy a large part of the student's attention and form extensive exercises for his classroom and home study. Whenever he works an example in algebra, tests for an acid in chemistry, employs a method of study in history, conventionalizes a figure in drawing, or performs an act because he thinks it is right, he is applying a principle or principles acquired in previous study. The writing of an essay in English composition, although primarily an exercise in expression, is none the less an application of the rules and principles in the employment of which the student seeks proficiency. Thus the application serves to complete the concrete-abstract-concrete movement of thought as suggested in an earlier chapter.

One of the forms of application which is gaining in availability because of its increased employment in present-day teaching is that afforded by laboratory instruction. Whether the chief aim of the laboratory procedure is verification or discovery is a question to be treated in the succeeding chapter. In all its forms, however, whether the experimental or the observational, in the library or in the field, the student is at almost every step applying some principle of fact or of method. His manipulation of the galvanometer is an application of previously studied laws of the electric current. The drawing of the botanical specimen involves his application of various principles already acquired. In a similar way

laboratory exercises in mathematics, in history, in English, all involve the factor of application.

Whatever elements may be involved, application is probably one of the most important, perhaps the most conspicuous element in translation in the study of foreign languages. Here the student finds constant occasion for the employment of the grammatical laws and rules of his previous study. Each phrase and clause must be interpreted only by means of these rules and laws. The forms of words, their order, and even their selection must be justified by means of principles to which they can be referred. Problematic and appreciation modes are frequent components of translation, yet their presence does not preclude but rather involves the application mode as well.

Possibly the most common as well as typical form of application is that afforded in the exercises and problems commonly assigned both for classroom and for home work. The development of a principle of method in algebra is followed by the assignment of a number of "examples" to be worked, at the board or in the home study. When the physics student has learned the law of falling bodies, he is called upon to compute a variety of instances prepared and selected to involve that law. Having been shown the method of comparing two authors as to type of imagery, he is assigned similar exercises for laboratory study in library or the home. The development of the ablative absolute in the class exercise is followed by exercises to be prepared in which that language construction is to be employed. A large part of the student's activity in drawing, manual training, domestic science and art, and the commercial branches may be classed as application. Thus, the list of forms of classroom and home study exercises, as forms of application procedure, might be extended through the various studies of the school curriculum.

3. Home Study as Application

Mistaken Conception of Home Study.—The meaning and function of the assignment for home study are perhaps less often clearly understood, even by comparatively good teachers, than is any other part of the instruction process. Not infrequently home preparation of lessons is interpreted as the real learning activity. The student is supposed to learn his lesson at home in the evening, so that he will be able to recite it in school the next day.[1] This is but another phase of the old conception of the class exercise as distinctively and primarily a recitation exercise. The fallacy of the latter we have endeavored to indicate explicitly in the preceding chapters of this text. It is hoped that the corresponding fallacy regarding home study has thereby been shown at least implicitly.

Earlier in our study we saw that learning and feeling occur only in response to a clearly recognized situation, and that it is the teacher's function to bring this situation to consciousness and to incite and guide the response to it. In other words, the teacher is an essential in the most effectual learning and feeling. In the exploration of unknown realms of thought, the pupil is too immature, too inexperienced to be an independent self-teacher, even though he must needs participate actively in the instruction process. Development is, as we have seen, the most effectual and satisfactory method

[1] In the *Ladies' Home Journal* for January, 1913, is given an incident which illustrates strikingly the principle we have just suggested. A widow came to the superintendent of schools with the following complaint: "I have four little girls attending your schools. I am up at five o'clock in the morning to get them off to school and to get myself off to work. It is six o'clock in the evening when I reach home again, pretty well worn out, and after we have had dinner and have tidied up the house a bit it is eight o'clock. Then, tired as I am, I sit down and teach the little girls the lessons your teachers will hear them say over on the following day. Now, if it is all the same to you, it would be a great help and favor to me if you would have your teachers teach the lessons during the day, and then all I would have to do at night would be to hear them say them over."

of dealing with new material in instruction, and the impossibility of development in home study negates any conception of the latter as essentially the meeting of and response to fundamentally new situations.

Relation to Class Exercise.—If, then, home study is neither preparation for recitation nor lesson development, what is it? A possible reply, and one often heard to-day, is that it is superfluous or even positively harmful. The other reply, and that on which the present section is based, is that the home study is primarily a continuation of the class exercise procedure, to be carried on and brought to completion after the class hour is over. "Home work should have the character of completing the class work of the previous day, not of preparing for the next. This will enable even the slow pupil to apply his time to it with success and profit. Let the pupil struggle with really new work under the supervision of the teacher, but let home work be preceded by enough similar work in the classroom to furnish the pupil a clew to prevent his working in the dark. With this new rôle assigned to the home work a change in class methods should follow."[1] Thus its basis is always in the class exercise which preceded it, and not in that which is to follow. It has a backward rather than a forward reference. It may mean the application of the principles or facts of the class exercise to other similar problems; or, since not all new material has to be taught in the classroom,[2] it may consist in the study of new problems, employing the methods of investigation acquired in class. In either case, however, it is an application activity, whether of fact, of process, or of method.

To the much-discussed question, Is home work justifiable? we are now prepared to give an at least relative answer. If the application activity can be so much better completed in

[1] E. R. Breslich, in article, "Supervised Study as Supplementary Instruction," in *Thirteenth Yearbook of the National Society for the Study of Education*, part I, p. 70.

[2] *Cf.* p. 118.

the classroom than in the home that it is better to restrict it to the former entirely, a negative answer is implied. On the other hand, if we decide that the maturity of the high school student and the brevity of the class period are such as to render home study more of a gain than a loss, all things considered, we are rendering an affirmative answer. The aim and value of home study will receive more adequate consideration later (Chapter XII). It will satisfy our present need thus to point out the basis for the choice of procedures, and indicate some of the essentials which a home assignment would involve.

4. Essentials of Expression and Application

Since the expression and application procedures are the final step and in a measure the climax of the instruction, their significance in determining the final form and meaning of what is learned and felt is obviously great. Feeling and learning must culminate in expression and application, or their value will largely disappear. Naturally we determine the essentials of good expression and application by reference to their function, since a procedure is good in proportion as it adequately accomplishes its aim. Expression is the transmitting to others of one's knowing and feeling experiences. The application factor of instruction serves the general purpose of bringing the abstract concept or formal principle down to the level of the concrete, converting ideas and ideals into things and acts. In so doing, both afford opportunity for testing the results of the development procedure, and provide definiteness and completeness to what has been learned and felt, and skill in its use. Thus the two partially coincide in educational value, as they often do in character. As the classroom application and the home study differ somewhat in function, the latter being an expansion of the former and under the student's own initiative and guidance, the requirements of the two will only partially coincide.

1. **Adequacy.**—Expression shall be adequate, both in form and in content. Because of its value for linguistic training, whether oral or written, care should be taken not merely that the expression be in good English but that the language be so chosen as to convey the correct meaning. Care in the construction of sentences, as well as in the selection of exact terms, is essential if expression is to realize its possibilities for linguistic training. The requirement that the content be adequately expressed follows naturally from its value for the rendering of thought and feeling definite. Nothing will so effectually clarify and organize mental experiences as will their expression, involving as it does their elevation to consciousness and their arrangement and formulation for another person's interpretation. Training in expression must train the pupil to think of what he says in terms of the hearer or reader.

2. **Genuineness.**—The expression shall be genuine. The student's reporting as his own an experience which he has not had occasions harm to himself and mistaken belief on the part of the teacher. He may, by a clever or lucky combination of phrases, get credit for the idea desired, though the idea itself be imperfectly understood or wholly lacking. He may for any of several reasons seemingly express a certain sentiment which he does not really feel. Intellectual insincerity may not be wholly the pupil's fault, but may result in large measure from overpressure by the teacher, or even from the student's conscientiousness. Under the necessity of saying something appropriate, he says what he thinks is wanted, even perhaps imagining he knows or feels what he is endeavoring to express. The teacher's most adequate remedy seems to be to follow up the statements with questioning, and to manifest and emphasize a higher evaluation of truth than of appropriate answers.

3. **Immediacy.**—The application in the classroom should follow immediately after the principle has been developed. An abstraction which does not have its concrete application

closely bound to it will soon disappear. The significance of a concept is intelligible only in terms of its relation to the concrete world of the student's experience, and either the two must be present simultaneously in the student's consciousness or they will fail to be properly associated and identified. When the student has come to understand the binomial theorem, he should then and there raise a number of binomials to higher powers. When he has learned the method of conjugating a Latin verb, he should be called upon to conjugate other similar verbs. The development of the principle of capillary attraction should be promptly followed by its application to phenomena involving it. After the class is shown the method and view-point of the interpretation of a literary selection or a historical period, opportunity should be provided for the further interpretation with this newly acquired method and view-point. In foreign language study, writing from dictation, which is itself a form of application, should at once be followed by correction of the work done, so that the correct form rather than the incorrect may become the permanent possession of the pupil.

Herbartian pedagogy collects the entire application activity into a distinct step, called the Application step, and naturally places it at the end of the class exercise. That the class exercise may very profitably close with a good degree of application is an evident and important consideration in secondary instruction. There it may well serve as a unifying procedure, showing the relation between seemingly disconnected ideas through their bearing upon common problems and situations. There are many times, however, when an at least partial application of a point may best be made immediately upon its presentation, mingling the development and application factors in instruction. In such cases, which in secondary instruction are especially common, a further distinct application procedure at the close of the hour is by no means precluded but rather is frequently desirable.

4. **Typicality.**—The application should be typical. The lesson development is necessarily restricted in the range of

cases studied, most of the emphasis being laid on a single representative instance. In applying a principle, therefore, its range should be extended, in order that the various forms in which the central thought is found may be such as to at least indicate the scope of its validity. Though the abstract principle takes a single formulation, its concrete forms are necessarily various. When the student has learned that the difference of two squares factors into the sum and difference of the numbers, he should apply the law to a variety of forms of the problem: *e. g.*, $a^2 - b^4$, $x^2 - 4$, $4x^2 - 1$, $4a^2 - 9b^2$, $a^2 - b^2 - 2bc - c^2$, etc. Having observed the general effects of wave erosion, he should apply the principle to a number of cases which represent the different types of situation in which it is involved. Evidently these should be progressively complex, so that each involves an advance and development out of the preceding, in accordance with the suggestion already made: "Proceed from the simple to the complex." The ambitious teacher is in danger of endeavoring to develop the student's ability to apply his new-found knowledge by giving him too large a proportion of difficult problems. The student must first "find himself" in problems within his grasp, and then gradually advance to more difficult ones. Often a multitude of easy applications of a principle to cases arising from actual experience will do more to secure readiness in its use than a small number of difficult ones.

The home study exercise should, like the classroom application, be typical. The chief difference would lie in the fact that whereas the latter for want of time merely *introduces* the student to each type, home study involves more extended drill or detailed investigation upon a number of cases under each type. The work of the class exercise is thus adapted to procedure under guidance; the home study demands rather the initiative and self-reliance of the student working alone. This is not to imply that the home study shall not introduce the student to anything new. It means, rather, that it shall deal with material or problems to which the lesson hour has introduced him and for whose study it has prepared him.

It is just this procedure from what has been studied to its further implications and applications which constitutes true progress, and such progress as this is to characterize both the classroom application and the home study exercise.

5. **Significance.**—The application shall be intelligent. When the student seeks to apply a method of procedure, he must know not merely the *how* but the *why*. He must be conscious of the aim of the procedure, and must see that the method employed is really the appropriate one for the realization of that aim. Too often the so-called application activity of the high school pupil is mere imitation. He sees how the teacher performs the operation, and when called upon repeats the process mechanically, indifferent to its justification. A fundamental aim in education is the training of the student intelligently to meet situations in life by adaptation of means to end. Not merely does the mechanical application fail to fit the student for the meeting of the specific intellectual situation under consideration, but it inculcates the mental attitude and habit of unintelligent imitation in all activities of life. This is clearly a failure to develop initiative; a violation of the principle of student self-activity.

Application is not intelligent unless the student appreciates the character of the end sought, and realizes that his efforts are at least an approximation to that end. A certain degree of conscious success is necessary for profitable effort, especially with younger people. In the study of a foreign language an attempt to translate into the new language before one is sufficiently advanced leads to an artificiality of product which is distasteful to the student and at the same time induces bad habits which negate any benefit otherwise derived from the exercise.

6. **Universality.**—The application activity of the class exercise should be general. It is not enough that one student should make the application and the rest of the class render intellectual assent and approval. The testing aim of the application procedure is evidently defeated thereby; much

more, the aims based upon the student's intellectual training. In so far as possible, every member of the class should himself make the applications, as intensively and extensively as the conditions of the class exercise permit. It is here that the use of the blackboard is of especial service, and the teacher may well so plan the lesson as to make provision for its use in so far as the character of the work permits. When but part of the class can work at the board, seat work can be utilized for the remainder, although the inconvenience of its employment for class discussion and criticism is a serious disadvantage.

The requirement that application shall be general, however, does not mean that every student shall, either orally or in writing, make every application demanded of the class. As was suggested in the discussion of the question, the student who conscientiously and fully follows through the thought of his fellow student's application, comparing it with his own thought in the matter, is in no small degree making a real application, even though unexpressed, and derives a real benefit from the recitation of every other member of the class.

5. The Lesson Assignment

Relation to Class Work.—In an earlier section of this chapter the function of the home study was seen to be that of an application and amplification of the material developed or method employed in the preceding class exercise or exercises. Incidentally, this naturally implies that it is usually to form the basis for the recitation procedure of the class hour, and in a manner to thus serve as a propædeutic for the subsequent lesson development, thus completing the cycle and constituting the unity of the instruction process from day to day. When home study is eliminated, it simply means that the application procedure of each class exercise is so extended and so organized as to include the work usually assigned to the home.

This relation of the home study to the application procedure of the previous class hour adds a new importance to application. Too often the teacher, pressed for time at the close of the hour, leaves all the application work to the home study, with disastrous results. The first application of a newly encountered principle or method is usually a source of considerable difficulty for the student, and needs the close attention of the instructor, guiding, adapting, and correcting. Unless the teacher has introduced his class to the concrete implications of a lesson and tested for the adequacy and accuracy of the learning, the next class hour will very often disclose results which are valueless or even of negative value. At the same time, one of the chief aims of home study is to develop initiative, and the classroom application fails if it does not train the pupil to do hard things, to master difficult problems independently.

Time of Assignment.—At what time in the class hour should the lesson be assigned? The function of home study and its relation to the application procedure naturally suggest that it should come at the close of the hour. Some educators, realizing its importance and the great danger of its being slighted if left to the close, have advocated for it an earlier position: even the first place in the class hour has been accorded it by some teachers of good standing. However, the policy of doing a thing wrongly for fear of neglecting its performance entirely does not appeal to us as justifiable. The teacher can as truly reserve a place for it at the close of the hour as he can plan to close the lesson at the end of the hour. On the other hand, the arguments in favor of its location after the application procedure are too strong to ignore. The assignment of a task is at best vague and uninspiring when its significance is not understood. An assignment should not take the form so often found: "Take the next three pages," "Work the first ten problems on page 40," "Write an essay on some topic which interests you." A truly educative task is one that arises out of a definite situa-

tion which is in a general way understood by the student and challenges him as a thing to be done for the meeting of the situation. To assign the lesson before that situation has been developed prevents this interest because it provides it no foundation. The lesson assigned, therefore, must be one that makes a real appeal to the student's interest, if any real educational value is to be derived from it or if the student is expected to put his best efforts into its preparation when the stimulation of the teacher's activity is not at hand. Such an interest seems to demand for the assignment the final place in the class exercise.

A modification rather than a violation of the above is the plan of assigning the next lesson piecemeal, by letting its various parts suggest themselves from the class discussion during the lesson development or classroom application. This practice is often wise, although it demands a final gathering together, organization, and restatement of the whole at the close of the hour.

Definiteness.—A requirement closely related to what we have just said is that the assignment shall be definite. The class, when told to work upon a task by themselves, should know definitely what is expected of them. One of the most fertile causes of poor lesson preparation is indefinite lesson assignment. Moreover, the adult teacher, who has the task in mind before expressing it in words, will consider clear what is quite the opposite to the immature student, who has to read the teacher's meaning out of his words. A wise plan is, after the assignment has been made and opportunity afforded for questions, to ask for its repetition by some student or students, probably one most likely to misunderstand or neglect it. Definiteness, however, means more than clearness. A definite assignment is one that has a real purpose; one that obviously leads somewhither. Intelligent preparation is possible only when its aim is known to the student and determines his procedure. Otherwise interest as well as efficiency will be lost.

Motivation.—The motivation of the assignment should be internal rather than external. Its content and form should be such as to stimulate to its performance, instead of requiring external authority as its incentive. The formulation of an assignment in question form often assists in securing this stimulation, for a well-formulated question is for the student a standing challenge, and its service in the humanities is as real if not as extensive as in the sciences and mathematics. "What similarity do you see between the causes of the American and of the French Revolution?" "See if you can determine the motive of Portia in demanding the ring from Antonio." "Just what does *virtus* mean in English?" Problems such as these are fully as stimulating as the calculation of the fall of an imaginary body in a given time, or the factoring of $x^7 - y^7$. Such intellectual stimulation in the assignment serves to carry over interest from topic to topic and from lesson to lesson, making it progressive and unifying the whole subject, instead of the atomization which daily assignment of new lessons tends to occasion.

The class exercise does not constitute the educative process but merely initiates it. The student who has not in school received an incentive to self-education in later years is not educated. Similarly, a class exercise which does not incite to further thought and study without the compulsion of the teacher's presence has little educative value.

Amount of Assignment.—The efficacy of the stimulant is in part determined by amount of dose. The motivation of the assignment depends much upon the degree of its difficulty. It must not be such as to save the pupil the necessity for hard work, for meeting and mastering a puzzling situation. In fact, like all of the work required of the pupil, it should be all he can do; no more, no less. That is the kind of lesson he takes delight in mastering. The absence of the teacher and the consciousness of being thrown upon his own resources is an excellent stimulant for arousing the student's self-activity. Thus, the assignment should be so selected and

formulated as to develop initiative and self-reliance. The consciousness that one can and must accomplish a difficult task is a fine tonic for the development of intellectual and moral muscle.

6. Summary

Expression and application are the student's extension of his experience to persons other than himself and to cases other than those from which the experience was derived. Such expression and application serve to complete and vitalize the experience, to test the efficacy of the instruction, to define and deepen the impression, and to develop skill.

Expression and application occur in nearly every step of the instruction, in class exercise, laboratory, and study.

The home study is merely an extension of the previous class exercise, not a memorizing for a coming recitation.

Expression and application should be adequate, genuine, immediate, typical, intelligent, and general.

The lesson assignment should grow out from the development, should normally come at the close of the lesson hour, and should derive its motivation from that of the lesson developed.

QUESTIONS FOR DISCUSSION

1. How will it affect the pupil's attitude toward a subject if he lack opportunity or capacity for self-expression?
2. How, if he lack opportunity for the application of what he learns?
3. Does teaching by lesson development add to the opportunity for self-expression (as compared with mere home learning of lessons)?
4. When a student has turned in the solution of an assigned problem in mathematics or language, how can you make sure that he has really applied a principle, and not merely imitated a process?
5. When a pupil knows a thing adequately and clearly, can you believe his protest that he cannot express what he knows? What might obstruct expression in such a case?
6. Can the expression of a sentiment be really genuine when it takes the form of reading what another has written?

7. Why should not the application of a principle be deferred till the day following its development?

8. "The application activity of the class exercise should be general." Why may not all profit equally if the application by one pupil is carefully followed by the others?

9. To what degree should the class have a share in determining the assignment of the lesson for home study? Give reasons.

10. What attention should the teacher give to pupils' protest that assignments are too long or too difficult?

SUPPLEMENTARY READINGS

De Garmo, "Principles of Secondary Education, Processes of Instruction," chap. VII.

Parker, "Methods of Teaching in High Schools," chap. XI.

Betts, "The Recitation," chap. V.

Carpenter, Baker, and Scott, "The Teaching of English in the Elementary and the Secondary School," chap. VI.

Wilkins, "Spanish in the High Schools," pp. 186–189.

CHAPTER XI

THE LABORATORY MODE

1. Character and Function

Scope.—We are largely indebted to the natural science study in schools for the recognition of the possibilities of the laboratory as an element in secondary instruction. Despite the abuses which have crept into the schools under its name, educators are more and more coming to see that the laboratory procedure is applicable to most if not all of the high school studies, and as its function is better understood, its employment becomes wider and more effectual. The term does not to-day necessarily suggest test tubes and electromagnets, but its use is based upon a more fundamental characteristic. It now refers not to the form of apparatus but to the form of thinking and learning, and accordingly we find it employed in the biological sciences, in mathematics, in history, and in English, even though it occasionally bears a different name in certain fields, and hence often escapes recognition.

Relation to Home Study.—The laboratory resembles the home study in that the student is to a considerable degree thrown upon his own resources. The formal procedure of the classroom, incidental to the simultaneous activity of a group under class direction, is replaced with the freedom of individual activity. On the other hand, in place of the independence of the home study there is, in the high school at least, a considerable amount of supervision by the teacher or his assistants, necessitated by the environment and equipment for the work as well as by the element of investigation involved.

Relation to Development.—Although like the development mode of instruction in dealing with situations and problems

at least partially new, the laboratory mode differs from the other in most or all of four essential features. In the first place, it deals with problems whose data demand slower development. For the performance of many chemical or physical experiments, the observation of geological formations, or the investigation of a historical period, the class hour is far too short. Secondly, the data of its problems are usually less accessible for study. The phenomena of stream erosion must be visited, or the reference books must be used in the library. Thirdly, its problems usually demand data which best lend themselves to individual rather than class investigation. Often a scientific specimen cannot be examined by an entire class, but must be duplicated for each student for close observation or individual manipulation. Finally, the treatment of its problems involves no really new method of procedure requiring a showing-how, but is the concrete application of a comparatively familiar method.

Relation to Application.—Compared with the application mode, the laboratory mode bears resemblance more in form than in educational character and function. It usually differs from the other in two respects. The first and most frequent difference is that the laboratory involves the element of discovery, the intellectual or sentimental interpretation of new truth, or the deriving of new experiences from things. Otherwise expressed, the application leads into, the laboratory starts from, the concrete. The former uses known principles in dealing with particular typical cases; the latter investigates concrete situations, and from them derives facts and experiences new to the student. Thus, in the laboratory the student studies particular plant forms, and derives general principles regarding the class typified by the specimens observed. In the appreciation laboratory his study of literary selections leads him to a new sentimental experience. Even when employed for verification instead of discovery, the same distinction holds good, since verification is the completion, the culmination of discovery,

and is therefore ultimately for the sake of knowing certain general principles rather than their use in any particular case. The use of the laboratory for the purpose of verification is, however, questionable and will receive treatment in another paragraph. A second difference, which is solely one of degree, not of kind, lies in the greater tendency of the laboratory to concern itself with actual objects and of the classroom application to deal with the symbols for things. Applying in the classroom the law of falling bodies, the student calculates the rate of *imaginary* falls; in the laboratory the body actually falls and its rate is measured. This second difference, if such it deserves to be called, is not fundamental but merely incidental. On the one hand, much of the work with maps in physiography and with sources in history is truly laboratory work if employed as training in the discovery and interpretation of truth, even though its materials are themselves representative and artificial rather than original.[1] On the other hand, classroom application should so far as possible be made to the real rather than the representative, and it is largely its shorter period which compels it often to substitute the symbol for the thing symbolized as a measure for the economy of time.

Aims of Laboratory Instruction.—The laboratory mode has been found to coincide in function and character with neither development, classroom application, nor home study, and yet it overlaps and partially coincides with all three. Taking account of what has been said in the preceding paragraphs, we might indicate five specific aims of laboratory instruction, most of which at least are fundamental in every laboratory exercise. First, it is for the sake of knowledge, or in some

[1] If the source method in history is treated as a study of a historical event or period through the medium of the impressions and motives of its contemporaries, and for the sake either of a better understanding of the event or of training in interpretation, it may well be a laboratory procedure as here understood. The position here taken thus differs less in character than in name from that of Bourne, in his "Teaching of History," chap. XI.

cases for the sake of appreciation. By it the student is brought to a more direct experience of situations. He comes not merely to *know about* things but to *know* the things themselves: he not merely learns to appreciate under guidance specially selected portions, but he encounters literary wholes as the author produced them. It may be primarily the extension of knowledge, the clarifying and impressing of knowledge, the broadening and deepening of appreciation; any or all of these. A second aim, no less real than the first and by some considered subordinate to it alone, is the application of methods of study and investigation to concrete situations of life. By it the student is led to *know how.* The third and often the chief aim of the intellectual laboratory procedure is the training in observation and induction, in analysis and synthesis. Confronted with the concrete data and objects, he is called upon to perform much the same intellectual process as that of the lesson development, including interpretation of the situation, hypothetical solution, reasoning out of implications, and verification. Employing the method of study learned in the classroom, he is constantly called upon to observe purposively and independently the situation itself, and inductively to draw general conclusions from the data he has observed. Thus he acquires accuracy in the observation of qualities and quantities, and independent judgment in the meeting of situations. A fourth aim, not always functioning in all forms of laboratory work, yet occasionally of prime importance as in domestic science and manual training, is that of technic and manual skill. The manipulation of apparatus, the drawing of specimens, and their preparation for study all lend a training of real educational value. A fifth and final aim, that of verification of facts learned in class, is one to which considerable objection has been made. That verification is an essential in discovery is not questioned, but that it should be made the primary intellectual aim in the laboratory is believed to thwart the spirit of independent thought and scientific method. It virtually

consists in telling the student that a certain thing is true, and then, assuming his incredulity, it orders him to see for himself. The truth is that students seldom think of challenging the statements of their teachers or text-books, and hence the verification, as such, is to them usually perfunctory and superfluous. Doubtless the frequent employment of the laboratory for verification rather than discovery is due to the greater convenience of its administration. It is far easier to familiarize the student with the facts in class, telling him by way of anticipation what to look for, than to lead him to the discovery of the truth for himself; to work from the classroom to the laboratory than from the laboratory to the classroom. In observational laboratory work, such as botany or zoölogy, involving many seemingly arbitrary data, minor points not readily observable by the student yet basal for the general inferences of the exercise may often with profit be supplied to him for verification.[1] The verification aim, however, is at best a very subordinate one, and must be treated only as incidental to the broader and more ultimate aims already mentioned.

2. Types of Laboratory Work

Classified on the basis of the control of the student over his material, and the consequent form of intellectual process, we find four types of laboratory procedure—the experimental, the observational, the appreciation, and the application laboratory—the fundamental difference between which is suggested by the names applied to them.

Experimental.—The experimental type of the laboratory mode, the form which first found its way into the schools, is that in which the student, in quest of knowledge, controls his materials and processes rather than observes them as he finds them. Experimentation consists in forcing the phenomenon studied to occur under one's control. One by one, he varies the factors of the situation and watches for con-

[1] *Cf.* Lloyd and Bigelow, "The Teaching of Biology," p. 308.

sequent variations in the result. Unlike the observational laboratory, the experimental procedure when adequately conducted needs but a single observation of a given type of result, since its basis is the relation of cause and effect, not mere observation of facts whose cause is not adequately investigated. Having in a single fully understood instance determined the relation between pendulum length and vibration rate, the principle of the uniformity of nature relieves the observer of further trial. Since the high school student is seeking the discovery of principles hitherto not unknown, although unknown to himself, he can in his control of the conditions of the experiment take advantage of the experience of others, so that his variations of the factors are the result of selection made by others. In Professor Dewey's words, he is playing with loaded dice, so constructed as to give positive results, to "come out right." In the majority of cases, since qualitative control and observations are more simple and less exacting than quantitative, they should precede the latter, which should then serve as their interpretation and application. The too early and extensive use of quantitative experiments in physics is an illustration of a frequent violation of this principle, due partly to the greater ease with which such exercises are devised and made definite to the younger student, partly to the failure of the college-trained teacher to differentiate between the purpose of physics study in the high school and that in the college.[1]

Observational.—The observational type of laboratory study is the more recent in its introduction in the schools, and partly on that account the less systematically developed and extended. Moreover, much which is really laboratory work in the study of the humanities is not given the name, perhaps due to a misconception as to the real meaning of the laboratory mode. Roughly classified, there are two varieties

[1] Professor De Garmo gives an especially suggestive discussion of the nature of experiment in education in his "Principles of Secondary Education, Processes of Instruction," pp. 14 *ff.*

of observational laboratory study. The first is that in which the materials studied are already collected and incorporated as a part of the school equipment, in a suitable room or department variously known as the laboratory, the museum, the library, etc. In the second variety, known usually as the field excursion, the material of study is such as to prevent its collection in the laboratory, either because transportation is impossible or because the environment in which the material occurs is a fundamental element in its study. The first variety is that usually employed in the study of the biological sciences, physiography, and the humanities. It includes the library work in such studies as history and much of that in the foreign languages and in English. The use of photographs, stereoscopic and stereopticon pictures, and museum specimens, when made the basis for serious study by the student, as well as of maps in history and physiography, provides many serviceable forms of this first variety of observational laboratory. The second variety, that of the field excursion, has a much narrower range, being usually employed in the biological sciences and physiography to supplement the work done in the classroom and school laboratory. The study of civics, wherein the students make first-hand observations of civic procedure and conditions, offers a splendid field for the field excursion. The Germans, in their study of history, have something similar to it in the Schulreise or school excursion to some place of historic interest, a plan which in a less degree might well be attempted in America.

In the observational laboratory the activity in which the observation culminates is usually description, though with inference as an occasional secondary or even primary activity. The description may be in the form of language, of drawing, or of both. When directed to report what he has seen, the student becomes a more careful, accurate, and adequate observer, and that which is observed is more deeply impressed; whether that report be in the form of words or of a drawing naturally depends upon the subject matter. A laboratory

exercise in literary interpretation or comparison, in history, or in fact in nearly all humanistic studies, naturally involves a report in language. In botany, zoölogy, physiography, and physiology, extensive use is made of drawings to induce and direct the observation, as well as to report upon it, and drawings which serve only as unthinking reports are practically valueless, except for the development of technic, an aim for which such studies are not primarily intended. For the study of relations and general features, diagrammatic drawings are the more serviceable; for the observation of details, descriptive drawings are of more value.[1]

Inference, as the second element in the observational laboratory mode, is not always present. It enters when an aim of the exercise is the discovery of general principles, *e. g.*, in finding the general characteristics of different varieties of a species in botany, the general character of the poetical writings of a period of literature, or the dominant motive in a series of popular movements in a historical period. The value of training in independent inference in such cases is great, and opportunities for its development are more frequent than is often realized.

Comparing the two varieties of observational laboratory as to educational value, it would seem that in the first the materials are easier to study, better selected, and usually easier to describe, whereas in the second or field excursion they appeal to the student as peculiarly real, rather than symbolic and artificial, and a better training is provided in the observation of things as they occur in the environments of nature.

Appreciation.—The third type of laboratory, that for the sake of appreciation, is one which is seldom employed, and even then is usually called by another name. The word "laboratory" is for the English teacher so suggestive of brass instruments and mechanical manipulation that it seems to him incongruous when dealing with the finer sentiments of literary study. The incongruity is seeming rather than real,

[1] *Cf.* p. 115.

however, when the terms are rightly interpreted. There is no good reason why laboratory exercises in appreciation should not be made use of, and some attempts in that direction have already been made. The appreciation of literature is somewhat allied to the observational laboratory in that the student deals with his materials as he finds them. On the other hand, the student is active in the creation of situations, and the appreciation enters in the expression and realization of his own ideas and sentiments. The essential element in the appreciation laboratory, however, is the sentiment involved, together with its expression, rather than in knowledge and inference, as in the two other types. Naturally it is subject to the same general principles and requirements as the appreciation mode of class instruction, and differs from the latter only as all laboratory procedure differs from that of the classroom.

Application.—In the laboratory procedure the student comes not merely to *know about* things but to *know* things. Thus, its aims include the clarifying and impressing of knowledge, bringing the process or method to bear upon the concrete object. A further aim is the acquisition of technic and manual skill. Our fourth type of laboratory, which we shall call the application laboratory, is that in which these are the dominant aims. Thus, in intellectual character it is essentially an application procedure in laboratory form, and in common practice forms the application part of the class exercise. In terms of our classification of modes it is, as its name implies, a union of two modes,[1] and as such is subject to the practical requirements of both. Domestic science and manual training are the two conspicuous examples of studies employing the application laboratory. Naturally either of these will often provide occasion for experimentation, but the experimental feature is rarely the dominant one, and the typical lesson in them casts the application step into laboratory form, largely because of the character of materials involved.

[1] A circumstance less distressing to the teacher than to the logician.

3. Essentials of Laboratory Instruction

Probably nowhere else in the secondary school work do the details of procedure vary as widely with the subject matter as is the case in the laboratory mode. We will accordingly limit ourselves to a statement of the general principles governing laboratory procedure, and a few suggestions of their implications, based largely upon the form of thought and training involved. Our discussion will deal with three phases of laboratory procedure: the assignment of the problem or exercise, the teacher's function in the laboratory, and the treatment of results.

1. Problem Assignment.—In the assignment of the problem recognition should be made of the fact that only a problem which is a real one to the student, one which appeals to him as worth while, has any place in the laboratory instruction. Work which is meaningless and perfunctory destroys the chief element of the problem, the desire to find out something. Often a reconstruction or restatement of a problem in terms of the student's own experience will serve that purpose, by showing him that it has a practical bearing instead of a merely academic interest. In the secondary school this will usually require that the problem of the laboratory be one which originates in the work of the classroom, which has brought him to this problem as its logical result. The unfortunate plan, so common in physics, of assigning to students in the laboratory topics wholly unrelated to the work then being done in the classroom is clearly a violation of this principle. The excuse that the apparatus is too expensive to supply all of the pupils for simultaneous work upon the problems is really no justification, for what cannot be done properly might better be omitted. In fact, an experiment performed in the classroom by two or three students, and carefully, intelligently watched by the others who are held as responsible for results, as though they themselves were manipulating the apparatus, is truly laboratory work, and is

far superior educationally to individually performed experiments from which the purpose is lacking. With a proper degree of student participation, much that is commonly called demonstration may serve as laboratory procedure, and, to repeat a thought elsewhere expressed, participation is a matter of mind rather than of manipulation.[1]

A further requirement of the laboratory assignment is definiteness. The aim of the problem as well as the procedure in its solution should be clear and significant in the student's mind at the outset, for a lack of such aim induces mere play rather than work. This does not mean that he should be told in advance the results of his experiment or observation, for so doing destroys its character as laboratory work. Rather it means simply that he shall not be permitted to plunge aimlessly or carelessly into an investigation, but shall proceed with a distinct purpose to permeate and determine his procedure, and with laboratory instructions so clearly formulated that following them he cannot fail to secure the desired results. Account should be taken of just what he may fairly be supposed to know, so that he will have enough instructions for successful work, yet not enough to relieve him of the necessity for thinking, judging, and adapting for himself. Too specific directions reduce the laboratory exercise to mechanism. Merely the general requirements should be specified where the student is qualified, by due reflection, to choose and adapt his own details of procedure.

2. Function of Teacher.—The function of the teacher in the laboratory mode is threefold. In the first place, he is to provoke thought, rather than to supply it. By refraining from discussion of the problem, but merely giving hints and stimulation when needed for the student's intelligent procedure, he avoids the error suggested at the close of the last paragraph. The development of initiative and self-reliance for which the laboratory mode is peculiarly adapted may

[1] *Cf.* Bigelow, "Teacher's Manual of Biology," pp. 7–8; Welton, "Principles and Methods of Teaching," p. 93.

easily be destroyed by the teacher who tells too much. Far better than answering questions is asking them, and the skilful use of the question by the teacher in the laboratory will accomplish much by leading the student to a better evaluation of the facts he observes, for many a laboratory exercise is practically wasted because the inexperienced and unthinking pupil does not know which of his observations are fundamental and significant, which are incidental or valueless.

A second function of the teacher in the laboratory is to prevent waste of time and material. Due sometimes to thoughtlessness, sometimes to inexperience, the student may undertake a wrong procedure which would occasion the loss of valuable time as well as of material. Here, as elsewhere, "an ounce of prevention is worth a pound of cure." Moreover, high school students are immature and often thoughtless, and the greater freedom of the laboratory is likely to lead to a lack of concentration in work or even a spirit of play which will thwart thoughtful observation, and which the mere presence of a responsible teacher will usually prevent. It might be well to observe here that a little forethought on the teacher's part in the preparation and distribution of material before the class enters the laboratory will often work wonders in the prevention of disorder and delay in getting under way in the first few minutes of the exercise.

Thirdly, the teacher when supervising the laboratory study is in a position to direct the student to the sources upon which he is to draw. In the science laboratory it may be the stores of supplies or even the text-books, in the field excursion it is the plant or animal life or the physiographic formations, in the library it will be books of reference.

The work of the instructor in the laboratory is thus exacting, and the requirements of his qualifications many. The character of the work usually done demands assistants who should be able and intelligent lieutenants and should know not merely the subject matter and the technic of laboratory procedure, but the student's pedagogical need as well. This

refers in a peculiar way to the school librarian, who should be broadly educated, ready to co-operate with instructors, and able to interpret and wisely meet the needs of the high school student.

3. **Results.**—The use made of the results in the laboratory is as important as the securing of the results. The notion that a laboratory exercise is practically completed when the experiment is performed, the drawing made, or the class returned from the field trip is a common but unfortunate one. Rather it is but the beginning, the preparatory step, as a moment's reflection will show. Three requirements of the use of laboratory results suggest themselves.

First, they should be definitely thought through and their meaning sought. The facts merely as such are of no value; their value appears only when they serve to answer the question for which the exercise was originally designed. Not infrequently the deferring of the writing up of results until after the close of the exercise leads to their being better evaluated and more intelligently described.

Secondly, they should be adequately described, usually in writing, although a short quiz at the end of the laboratory exercise will often serve to bring to consciousness points otherwise overlooked and which before the following class exercise would have passed beyond recall. Adequate description will usually involve a statement of the problem to be solved, a description of the procedure and its results, and an interpretation of the significance of the results for the original problem of the exercise. Such a description, common in scientific study, might prove adaptable to laboratory work in the humanities as well. As a form of expression, it would tend to increase the clearness of the pupil's thought and deepen the impression made, thus rendering the results of the exercise more permanent. A well-organized form of the written description in the laboratory manual, if not carried to the degree of pedantry, will add much to completeness and systematic arrangement of both thought and description.

A third requirement is that the results of the laboratory shall be closely correlated with the work of the classroom. The recitation and development in subsequent class exercises should take account of what the student has learned in the laboratory, using the results as the basis of his further study. This practice adds greatly to his feeling of the value of those results, and in fact is indispensable for the continuity of the course as a whole. Occasionally the class might well make a thorough study of their laboratory results as recorded in their note-books, thus affording opportunity for recalling, interpreting, correcting, and organizing the entire laboratory work of the course.

4. Summary

The laboratory mode has a fivefold aim: (i) knowledge and often appreciation, (ii) application of methods of study, (iii) training in observation and induction, (iv) technic and manual skill, (v) verification (in rare cases).

The four types of laboratory procedure are (i) experimental, in which the phenomena studied are under the student's control, (ii) observational, including the study of materials collected in laboratory, museum, or library, and that of data best accessible through the field excursion, (iii) appreciation, which aims at sentiment as the first two aim at knowledge, (iv) application, which aims at skill in the application of knowledge, with the acquisition aim subordinate.

In the laboratory procedure the problem must be a real one for the student, and definitely formulated. The function of the teacher in the laboratory is to provoke thought, to prevent waste of time and materials, and to direct the student to the sources. The results secured by the student in the laboratory should be definitely thought through, and interpreted by him, they should be adequately described, and they should be constantly correlated with the work of the classroom.

QUESTIONS FOR DISCUSSION

1. In many college courses of instruction the entire work consists of laboratory procedure, without classroom exercises. Discuss the feasibility of such a plan in the high school.

2. It is said that in the experimental laboratory the student "is playing with loaded dice, so constructed as to give positive results." Does not this circumstance destroy the value of such study as a training in methods of scientific study?

3. Is the knowledge aim in the manual training and domestic science laboratory more fundamental in senior high school than in junior high school work? Why? In domestic science, might the laboratory be of the experimental type? Justify your answer.

4. Can the appreciation laboratory work serve at the same time as lesson study? If so, should it not be supplemented by independent study?

5. What are the advantages and disadvantages of a previous class exercise discussion of the coming laboratory exercise? What should characterize such a discussion, if provided?

6. Point out how the untrained laboratory assistant might violate all three functions of the teacher in the laboratory mode.

7. In case the student's report upon a laboratory exercise is very inadequate, under what circumstances should a repetition of the exercise be required?

SUPPLEMENTARY READINGS

Parker, "Methods of Teaching in High Schools," chap. XIX.

Twiss, "A Textbook in the Principles of Science Teaching," chap. VIII.

Goddard, "Laboratory Teaching," in *School Science and Mathematics*, November, 1916.

Luke, "The Springfield Laboratory-Recitation Method of Teaching Latin," in *School and Home Education*, December, 1916.

Moon, "Laboratory Methods of Teaching Contemporary History at Columbia University," in *History Teacher's Magazine*, March, 1917.

The *Wilson Bulletin*, especially the following articles: Mendenhall, "The School Library as a Laboratory," in the *Wilson Bulletin* for June, 1917. Warren, "Opportunities for Study in the High School Library," in the *Wilson Bulletin* for October, 1916.

CHAPTER XII

STUDY AS SELF-TEACHING

1. Significance of Study

Student Self-Control and Self-Direction.—In the classroom instruction the responsibility for initiative and direction necessarily rests mainly with the teacher. We saw in our study of the laboratory mode that one essential feature of that mode is its placing of a greater degree of responsibility upon the student. In outside study student responsibility reaches the most extreme form which school work affords.

The chief function of the school is to establish a gradual transfer of authority and guidance from without to within the child. The two fundamental activities of the school are its moral training under the form of discipline and its intellectual training under the form of instruction. In these the movement is parallel; the establishment of self-control and of self-direction respectively. Without the attainment of these two, the benefits of the school's training extend no farther than its walls. Perhaps nowhere do these two attainments assume so definite a form as in study, and nothing so surely characterizes the educated man as their manifestation in capacity and disposition for study. The school, therefore, which does not succeed in training its students to study fails to just that degree to produce results which persist after its activities cease. It has but written on the sand.

Justification of Home Study.—In an earlier chapter[1] the question was raised regarding the wisdom of abolishing outside study, and letting the class exercise include all necessary preparation for the next day's work. The question naturally recurs here, and the thought of the foregoing paragraph

[1] *Cf.* p. 195.

plays a large part in the answer. The youth will not always have schools in which to study nor teachers to instruct him. His education must lead to self-reliance and initiative in his post-scholastic study. In the primary grades self-control and self-direction are not possible or expected. In the high school a considerable degree of them is possible and to be expected. If now the work of lesson preparation be made wholly a classroom affair, under the constant guidance and stimulation of the teacher, it may well be questioned if we are not letting escape the best opportunity of school life for the development of self-reliance and self-control. Somewhere, at some time, the child must let go the teacher's hand and walk alone. If the transition from supervision to independence in study is to be made, as it ultimately must be made, the school life would seem to be the most natural, easy, and safe time for such transition.

2. Teaching to Study

With lesson assigned and class dismissed, the teacher too often imagines his task completed, his duty done. On the contrary, the very nature of the lesson assignment implies an activity in which the student is his own instructor and task-master, a condition to which only adult development can attain or even approximate. As teachers we assume that our students should be able to study properly and are blind to the fact that they do not and cannot. Only very recently have we realized that we must teach our students to study, and that at least a part of that study can best be done under supervision.

Self-Teaching.—Studying is really nothing more nor less than self-teaching. What the teacher has done for him in the class exercise, the student must in his study do for himself. For just this reason the best preparation for out-of-class study is classroom learning, and the best way to teach pupils to study at home is to teach the lessons well in class. The principles of study are really the same, whether applied to

classroom or home work. The causes of pupils' inability to study out of class are usually two: either poor methods of class teaching or a failure to cause students to be conscious of good methods *as methods*. Surely the teacher who cannot teach well will not expect his pupils to teach themselves well. And on the other hand, unless pupils see not only what is done but *how* it is done, they will not be able to employ the methods in their own work.

Importance of Teaching to Study.—Every normal child, whatever his motive for study, would rather succeed than fail in his efforts. Indeed, many pupils' dislike for study is due not to dislike for work or for subject matter, but to inability to accomplish what they undertake. And who can blame them? High school students are potentially better psychologists than we commonly suppose. With a little practical guidance they will effectually and profitably cooperate in a study of the best methods of learning their lessons. How to commit material to memory, how to attack a problem, how to hit upon the central thought of a lesson or a passage, how to see the significance of the paragraphing of the text, to use the table of contents, or to run down references, all of these are for them real, intelligent problems upon which practical suggestions from the teacher will be eagerly welcomed.

Lesson development is neither doing the pupil's work for him nor expecting him to grope in the dark in the face of new situations. Doing his work for him will never produce power for independent work; and doing things without consciousness of method or meaning will not lead to power to do them again or to do other things. Development is the inducing and directing of student activity in meeting situations, and as such provides the ideal basis for teaching him to study: to re-attack the same problem and to attack parallel and related problems on his own initiative. When in the class exercise the student is given just enough assistance with an activity, so that he himself does it and does it intelligently, and, fur-

ther, when his attention is specifically directed to the process as a basis for his own further activity, we may truly say that he has been taught to study. All five modes of instruction, therefore, and especially the problematic, appreciation, and expression-application procedures. naturally form the basis for teaching to study.

The Study Attitude.—The first essential in study, and one of the most vital, is the attitude toward it. This is largely dependent upon the assignment, which must be something of real value to the student. He must evaluate the result to be accomplished by the task as a thing which will meet a need, immediate or remote, in his further work. This necessarily arises from a knowledge of the problem to be solved, and he must be taught to begin by getting his bearings. The student must know the purpose of his studying. It is not enough that he do his work because it is assigned, but he must understand what it is to accomplish in order that he may adapt means to end and may know when the end is attained. Thus each assignment must be made primarily in terms of product rather than of process. It should not be a matter of "do this" but of "accomplish this." As teachers we must take our pupils into partnership with us, realizing the fact that the high school student is far more capable of an intelligent appreciation of ends and means than we usually credit him with being. Could we but overhear him at his study, we might often hear the complaint: "I suppose this is all of some use, but I wish I knew of *what* use." While it is, of course, true that much of the work has a largely propædeutic value which is but dimly recognized by the student, nevertheless a little special effort will give even this purpose a genuine appeal to him. When he feels that the teacher is appealing to his co-operation, and credits him with an intelligent attitude toward his work, the co-operation will usually be rendered and the attitude will develop until he feels that the assignment is his own self-imposed work rather than merely a task imposed by the teacher.

As one of the first steps in the preparation of the lesson, therefore, the pupil should be trained to seek its purpose; to ask himself just what it is intended to accomplish. What is needed more in our high schools is not a blind obedience to commands, but the attitude that challenges for the meaning of things. The world is already well supplied with unthinking followers; the secondary school is to develop leaders who are trained to investigate purposes before initiating actions.

Problems with plenty of action and with tangible results are particularly favorable for inducing this attitude. For example, the preparation of a careful comparison-contrast between the writings of two literary men or between the chemical qualities of two elements will induce far greater interest than an assignment of a disconnected study of each. Problems in which the student can see through to the concrete application of his thinking will induce a better attitude toward that thinking.

Things one likes to do are always better done. We must, therefore, give to assigned tasks as bright an aspect as we can, and must let the pupil see that a corresponding attitude on his part will lighten and brighten the performance. He must give his efforts not grudgingly nor of necessity, but cheerfully. Pretending that he enjoys it will tend to induce enjoyment, so let him seek to work as if he did enjoy it. He should be taught to do more than the minimum requirement, for in the gratuitous extra work, such as "reading out" from the topic, working extra exercises, and devising supplementary applications, the extra power and knowledge gained will result in enlarged interest. The teacher's personal attitude toward those who do more than the minimum will tend to increase their number.

Orientation and Organization.—Much of the difficulty of students in getting their bearings is due to the teacher's mistaken conception of the function of the assignment. When the student's task involves a plunge into unknown waters, it is little wonder that he flounders about; the wonder is, rather,

that he gets on as well as he does. With a definite assignment growing out from the lesson development, the student will have his bearings fairly well at the outset of his subsequent study. The problems arising, the intellectual needs to be met, will be his own, as well as the essentials for their solution.

If the assignment include a review of the preceding lesson, the orientation of the new work will be better insured. Getting one's bearings is largely a matter of perspective, and students do not know how to evaluate and organize. Experience has shown that even the high school pupil's study consists largely in indiscriminate memorizing of everything assigned or mechanical performance of the set exercises. Usually he knows quite well that not all things are of equal importance. His difficulty is that he does not realize which are the important, which the subordinate.

A useful device for the securing of organization is the preparation of an outline of the lesson. Often this begins with development of the power to read rapidly. Many students have never advanced beyond the stage of slow word-by-word reading, in which too often the trend of the thought is lost sight of in attention to details. Not infrequently this results from misdirected conscientiousness, more often from bad habits and lack of training. To train to read rapidly is in many cases the first step in training to organize.

Before the student can organize the lesson in the form of an outline, it is necessary to train him to evaluate and to see things in their perspective. As in the class exercise, so in his study he should be taught to attack any undertaking with the questions: "What is the thing which I am setting out to do? What is the central idea or principle or problem before me? What are the essential, what the subordinate points in dealing with it?" Outlining involves evaluation, and specific attention should be given in the classroom to the training of judgment, upon which all evaluation is based. In the classroom instruction the student should constantly be led to dis-

tinguish fundamentals from subordinates. Thus, he will be able to determine what parts to memorize, what to study intensively, what to pass over rapidly. Much of this training may form a part of a class exercise; some of it must be given individually, in supervised study or in personal conference.

Information-Getting.—The solution of a finding-out problem is a matter of getting information, and for information-getting the same principles hold in study as in classroom instruction. Of the three sources of information, observation is evidently better for the student's development than being told or even than reading in books. We should therefore urge upon him the advantages of looking first to his own experience and observation for the information sought. Often he has the information but does not realize it, because he has not fully interpreted the significance of what he sees or knows. Thus, he must be taught to first analyze his own store of information for anything that might bear on the problem.

At the same time we must warn him against the danger of taking his observation for more than it is worth. Books represent the experience and observation of others, presumably better observers than he, and he will do well to verify his observations by reference to these. He must also be taught to make use of books as sources of information. One of the greatest hindrances to intellectual progress on the part of students is their inability to make use of books. Often schools are inadequately equipped with books, but far more often use is not made of the books at hand. Far better to sacrifice somewhat in the selection of topics studied than to neglect training in the use of books because the ones preferred are not available.

Children should know what books to use. Every teacher may with profit spend a little time occasionally in discussing with his class the available literature dealing with the topic under consideration, pointing out what are good books, the

characteristics of each, and where in them to find what is wanted. The use of index, of table of contents, of chapter and paragraph titles, and of bibliographies can be easily explained, but for lack of explanation these are often neglected by school children.

The last resort in information-getting is the asking of other people. Who has not seen school children who mistook it for the first and only mode of finding out what they did not know? But although a last resort, it is an important one. Occasionally it may be used as a matter of economy of time, when the benefit derived from a laborious search in books would be more than offset by its cost in time and effort. More frequently, however, telling, especially by the teacher, finds its place when the *manner* of the telling is fundamental. Books may tell too much or too little; may do the pupil's thinking for him, or demand more thinking than he can do unaided. Following the general principle that the teacher is to do for the child only what he cannot as profitably do for himself, the teacher's assistance must take the form rather of stimulating, with occasional telling as needed. The telling must merely bridge the gaps in the child's capacity and experience. Often it may well be a telling of where or how to find out, rather than of giving the information sought. Books the student will or should have with him in life; the teacher is his but for a season.

Finally, reading and telling as sources of information should be followed by at least partial verification in observation and experience. Credulity results from a habit of accepting ideas unchallenged. We must teach students, after reading or hearing a thing, to check it up with already possessed experience and reason, and see that it is in harmony. If not, find out why not, nor stop till harmony in thought is established. This checking-up training will at the same time prove to be an excellent training in original discovery.

Memorizing.—Acquisitions, whether of facts or of processes, must be conserved. Study must secure the retention

of both, and must take account of the laws of memory-forming and habit-forming. In a concrete form at least, these laws are intelligible to the high school pupil, and he should be shown their application to his study.

Habit-forming requires in the first place a strong motivation, which in turn is possible only on the basis of consciousness of aim and understanding of procedure. Unintelligent drill lacks the vigor which should mark the initiation of habit. The student must therefore make sure that he knows just what he is doing and why he is doing as he is if he would give the process he is acquiring a strong initiative. It must have the zest of achievement, the consciousness of doing something. Secondly, as every schoolboy knows, repetition fixates habit. Here, too, each act must be permeated with the consciousness of the thing to be done and of the process as a doing of that thing.

In memory-forming the first rule for the student to observe is that the content must be deeply impressed. Recalling the suggestions of our earlier discussion, the student may profitably write out what he has read, thus establishing a motor image as well as a visual one. Note taking and note bookkeeping, especially if use be made of the notes in the study, serve the same purpose. Intelligent marking of books, making the significant points conspicuous, is an art which the student may profitably be shown and which will add much to visual impression. Reading aloud or listening while another reads will likewise reinforce with an auditory image. It might be well for the teacher to discover whether the child is not employing in study only the type of imagery in which he is strongest, and to suggest to him how the use of the others would help to reinforce the impressions made. He should also be trained to attain clarity of ideas before he seeks their fixation. Hazy ideas, like dull tools, make but shallow impressions, which soon disappear, and the student must form the habit of persisting until he knows exactly what he seeks to memorize. Usually it adds to the depth of impression to

allow it a short time in which to "set" before advancing to a new one. Impressions following too closely upon one another become confused, and tend to obliterate each other. Reviving an impression shortly after encountering it tends to deepen it; hence, a rapid review, either by reading or recall of a paragraph just read, will pay better than a review later on, though both are profitable.

In general, drill whether upon processes or upon facts should be frequent rather than consecutive, and the student should be taught to so plan his study as to break up the drill into occasional but brief periods. Secondly, he should know when to stop. This should be only when the drill has lasted long enough for a lasting, not a temporary, retention. Only when he finds that he can recall it without having revived it immediately before should he consider it learned. A rapid review of a lesson of whatever kind immediately before the recitation upon it is of great profit, provided the lesson preparation was itself thorough. In the third place, students should be taught upon what to drill. They should be shown that drill is applicable to processes and rote memory, but little if at all to logical memory. The one seeming exception would be in the case of formal rules or formulas of which the use must be too immediate and frequent to permit a rethinking of the steps by which the rule or formula was derived. In such cases, however, care must be taken that the formula of words merely supplements the thought and does not supplant it.

Equally important with the impression of an idea is its association. The farmer driving to town hitches his horse to a post, not to a car on the siding. He knows that when he seeks the horse he will find him, because he knows he can find the post. Similarly, the student should be trained to associate the idea he is learning with other and familiar ideas. Associations are based upon relationships. One of the first things for him to do, therefore, is to search out the relationships between the new idea and as many as possible familiar

ones. Thus, when he wishes to recall the new one, he can trace it back from any of the known ones to which it is joined. Evidently the more of such relationships are established, the more easily he can hit upon an idea that will lead him to his goal. And evidently the stronger the relationship, the more lasting and dependable the association. Mnemonic devices are almost always based on an artificial relationship, not a real one, and for that reason are often more of an obstacle than an assistance in recall.

Thinking-Out of Problems.—Not a little of what has been said on teaching the student to deal with finding-out problems is more or less applicable to the thinking-out problem as well. In the latter, as truly as in the former, the problem must be clear in the student's mind. He must know whether he seeks a generalization or a concrete application or both in one problem. Otherwise he will in the former case be prone to stop short with information about the illustrations rather than go on to the generalization. In the latter case, the relation between principle and application will not be adequately established. A clearly formulated statement of his problem, "the thing I propose to find or do is so-and-so," will tend to induce clarity of problem. Moreover, when the student has adequately recognized his problem and caught its significance, the second requirement, that the problem be a real one for him, will in large measure have been met.

The student does not need to be taught to form a tentative solution to a real problem, but he does need to be taught to form a good one. It is so much easier to guess than to think, and young people, lacking the sense of responsibility and the restraint of the instructor's presence, are prone to guess. They must be shown that mere guessing is not solving, but that results come only from sound hypotheses. Thus the formulation of hypothesis and the reasoning out of its implications are inseparable. The student must feel the importance of sound thinking, of challenging his conclusions, and of making sure that the solution *looks* rational, in so far

as he can discover. This challenge attitude must then culminate in certainty, with less than which he should not be content. An unverified hypothesis should produce a feeling of uneasiness; it should be an unbalanced force which will act until stability is attained. He must *know* before he is satisfied.

This demand for certainty is largely an attitude of mind, which can best be taught in the classroom by always insisting upon certainty in work and leading students to challenge and criticise their own and others' work. In these ways they come to associate certainty with solutions. However, they do not always know how to make certain. Much of implication and of verification demands a broader experience than the student possesses. He does not think of even familiar things and ideas as related to his problem. Much of this experience must be brought to bear by the teacher, especially in the assignment. One of the functions of the assignment is to suggest problematic situations and relationships, so that the pupil in his study will have his attention directed to them. The good assignment is the one that gives just the needed direction here, but at the same time shows the pupil how to look for implications and verification on his own account. It makes study effectual and thereby trains to study.

Appreciation.—Since appreciation-teaching consists in securing conditions under which the appreciation can occur, teaching how to study appreciation material is merely the teaching of how to create corresponding conditions in study. As the teacher in the classroom assists the student in the securing of those conditions, he must help him to create those conditions when by himself.

The first condition, an understanding of medium of expression and of thought, is one without which study avails little. We therefore must make the assignment such that the student will early familiarize himself with the medium of expression. This involves the development of an unwill-

ingness to let an unfamiliar word or phrase go unchallenged. In a way, this is but a phase of the general attitude already discussed, of intellectual unrest in the face of that which is not understood. The same holds of the study of the thought as well as of the language. It is often well to devise as a part of the assignment some exercise which demands an understanding of the content. Often this is best attained by bringing out the problematic element in the content, so that the solution demands a knowledge of language and thought.

Appreciation demands vividness of imagery. Pupils should be encouraged to picture to themselves the thing described. We must show them that the study is not merely reading but seeing, and suggest that often in their reading they occasionally pause while with eyes closed (at least mentally) they image to themselves the thing described. Visual and auditory imagery are especially easy to cultivate, and are essential to most literary appreciation. Occasionally the assignment may well include a search for appropriate pictures to illustrate passages, and add to the vividness.

But the student even more than the teacher is in danger of mistaking this sort of study for appreciation, whereas it is but the securing of conditions favoring appreciation. Æsthetic or ethical appreciation is based on a realization that the thing is beautiful or good, and such realization must be secured. Appreciation is taught in the classroom by leading the pupil to pass judgment on the beauty or goodness of a thing. In the same way, appreciation study must involve the forming of such judgments, and can best be secured by an assignment calling for these judgments. While the student may not always tell what he means by beauty or goodness, he can profitably search out and indicate those passages or features which he likes, and tell somewhat of why he likes them. The efforts will be crude at the first, but practice, properly encouraged and directed in the class exercise, will lead to improvement.

Application in Study.—Possibly the reader will at this point halt us with an objection. He may tell us that in an earlier chapter we referred to the home study as essentially application, whereas in the present chapter it seems to involve nearly all phases of learning and feeling. The discrepancy is but seeming, however, as an examination of the relation of application to learning and feeling will show. When a student, having learned a process or fact, employs that process or fact in dealing with various cases similar to that whence the learning was derived, he is applying what he has learned. This application may assume various forms, such as working examples, writing essays, translating, etc. In each case, however, the application usually consists of solving problems or appreciating writings by employing the method learned in the class exercise. Thus, the home study, while an application of what has been learned, is at the same time the meeting of other, though similar, situations, and as such calls for essentially the same procedure, whether problematic or appreciation. Thus an activity may at the same time be the solution of the problem and the application of a method of solution, in that the pupil solves by the method learned.[1]

Home study may thus in a double sense be application, whether it be of what was learned in class or of what was learned in the study itself. Thus the boy may learn in class how to factor the difference of two squares and apply the method to a series of home-study exercises, or he may in his home study by class-taught methods derive a mathematical formula and then apply it to appropriate exercises. For application in both these senses, the suggestions for home-study application are intended.

Since a function of application is to give the fact or principle or process a broad significance, it follows that the application should be made to a wide variety of exercises or cases. This is in part secured by a well-chosen lesson assignment.

[1] *Cf.* p. 195.

The student, however, should be encouraged to seek or invent as many concrete applications of what he has learned as possible. It is far more helpful to devise one application than to recognize two ready-made ones. For the same reason, he should endeavor to correlate what he has learned with as many other facts of his knowledge as he can. The fact learned in physics will mean much more if he sees its significance in explaining a hitherto puzzling phenomenon in botany or physical geography. The student who follows these two suggestions will by so doing stumble upon a surprising number of new and suggestive ideas.

It need hardly be pointed out that application should be intelligent and that pupils should be taught that true application is that of thought and not of form only. Not infrequently pupils work examples or apply processes by imitation. Effort must be made to render this habit unprofitable, and to develop an unwillingness to do formally that which is not understood.

Expression.—Expression naturally plays a smaller part in study than does application, yet often a considerable one. Evidently nearly all that can be done for its training is that of the regular class work. The preparation of essays and reports provides the home study basis for it, and these are properly the object of classroom criticism and correction. It follows that the neglect of the form of expression in any subject, whether English or history or physics, will produce bad habits, and in the case of reports based upon study, good expression should be demanded. At the same time, the pupil should be impressed with the idea that careless expression in that which he in study prepares for his own use only is quite as harmful as carelessness in reports for the class exercise. He should realize that expression is largely a matter of habit, and that all of his expression, whether for the class or for himself, plays a part in the formation of that habit.

Conditions for Study.—The conditions for study have more influence upon its efficiency for school children than

for adults. Moreover, those conditions are as a rule less under their control, and children with their limited experience and sense of responsibility do not usually make the best use of the conditions that surround them. Upon the school, therefore, devolves the obligation to provide the best possible conditions for study, and at the same time to train the pupils to the best use of those conditions.

Recent investigations have confirmed a fact long known to teachers—that the home conditions for out-of-school study are seldom good, and that students are often unwise in their selection of lessons for home study. On the other hand, the study room of the typical high school falls far short of being an ideal place for study. The physical essentials of the good study hall, such as good ventilation and lighting, quiet and orderliness, and the avoidance of physical and mental fatigue, are topics lying in the domain of educational hygiene and administration rather than of method of instruction. With a properly administered study hall, however, it is obvious that the conditions for study are as a rule better than those of the average home, and that there is normally the place for the preparation of lessons calling for the highest degree of concentration.

Physical Conditions.—Over the physical conditions for home study, however, the pupil has a considerable degree of control, especially if he realizes their importance and is determined to secure them. Teaching to study may profitably include teaching pupils the control of study conditions. Clearly, health is a first desideratum, and may be shown to depend much upon regularity of habits of work and recreation, abundance of sleep (preferably evening rather than late morning sleep), nourishing food, abstinence from hard work or study immediately after eating, and plenty of well-regulated out-of-door exercise. All of these tend to produce clear heads, ready thought, and a favorable disposition toward work.

Whether students should be encouraged to study always

alone or in groups of two or more is a practical and puzzling question to many a teacher. Certain it is that under favorable conditions the group study stimulates thought which would never occur to the student working alone. The dangers, on the other hand, are two: a habit of dependence in work on the part of the weaker student, and a frittering away of time in conversation on extraneous topics. If students can be trained to appreciate the importance of independence in thought, the spirit of true helpfulness, and the supreme importance of concentration upon the task in hand, the value of group study in subjects offering opportunity for discussion is certainly great. The author's experience is that the training of students to do group study with profit demands patience, sympathy, and watchfulness, but that in most cases results can be attained which more than repay the effort made.

Of the value and right use of time in study, pupils have usually very slight appreciation. One need but watch students in the typical study hall to be convinced of the enormous waste which characterizes their efforts, and necessarily becomes habitual with them. Much time is lost in getting started, due in part to a failure to catch the significance of the work confronting them, and in larger part perhaps to bad habits of work. They fail to realize that the first minutes of the study hour are fully as valuable as the last. Closely related is the lack of systematic planning of work to be done. A glimpse at one lesson, a spasmodic attack upon another, and a superficial survey of a third, and the pupil finds the hour gone with little or nothing accomplished. One of the fundamental lessons to be taught high school boys and girls is the importance of regular fixed hours for specific tasks and the employment of those hours to the best advantage. Experience has shown the great benefit derived from the establishment of definite schedules of study for school children. W. C. Reavis[1] finds that, by having each

[1] "The Importance of a Study Program for High School Pupils," in *School Review*, vol. XIX, pp. 398–405.

pupil work out and adhere to a regular study programme, the students get their work more expeditiously, study more steadily, distribute their efforts more appropriately, get their lessons better, and have more time left for extra-scholastic activities. Thus they can be led to evaluate time, to form judgments as to how much an hour of study should effect, and to realize the advantage of intense effort and concentrated attention. Setting a time limit upon the performance of a piece of work usually provides a stimulus to steady and intensive study.

In general it is better for a class to study a lesson immediately after its assignment. At that time its development and the meaning of the assignment are still fresh in mind, and the interest in the material has not been dissipated by intervening interests. A second advantage is that the fullest opportunity will be provided for the reference to library, museum, etc., for data needed in the lesson preparation. Further, such a plan prevents the too common practice of hastily and superficially preparing a lesson just before the recitation upon it, although a rapid review at that time of a lesson already mastered serves to renew impressions and should be encouraged.

Mental Conditions.—Of the mental conditions for study, whether at home or at school, the most fundamental is evidently attention. We need no psychologist to tell us that when we attend we observe more quickly, learn more easily, and remember better. How to secure and hold attention is something which not only the teacher but the pupil also would like to know, and suggestions on the subject will be welcomed by any serious-minded student.

Study is not sitting and staring at a book, while thinking of other things, but involves holding the thought to the topic under consideration. Possibly the greatest waste in study occurs in the form of dawdling, due largely to a failure to concentrate attention upon work. Recalling what was said in Chapter II, we must interpret most of this difficulty in

terms of interest. When a lesson makes no appeal to a student, it is but natural that other subjects, in themselves of little significance, should prove more interesting than the lesson and attract his attention to themselves. The solution of the difficulty must be sought in two directions. In the first place, the student must be trained to isolate himself from the distractions, partly by selecting an environment with a minimum of distracting forces, partly by determinedly and completely ignoring them and thus rendering them indifferent. This might be called concentration of attention by means of negation. The second and positive solution reaches back into the instruction of the class exercise, and is based on the principle that the thing given the pupil to do must appeal to him as worth while. When he feels the challenge of a problem, and wants to find out or think out something, when his feeling is really aroused by his reading, the temptation to attend to other things will not arise. The teacher must realize that not merely the content of the lesson but its form as well plays a large part in rendering its preparation interesting. Young people love action, and provision for activity must be made in the assignment. They must be given something to *do*, even though the doing involve an activity which of itself offers little value. Pupils in their study usually make too little use of paper and pencil, largely because the form of the assignment offers no occasion for their use. It is well, therefore, to let the assignment provide not only opportunity but occasion for written work. Encouraging pupils to outline the lesson and to summarize it in writing at the close of their study is thus advantageous, for the sake of the activity as well as for other considerations already mentioned. For the same reason students should be urged and trained to invent and introduce in their study devices for the employment of writing, not alone for the definiteness of thought thus encouraged, but because the activity facilitates mental concentration. By the introduction of this and other forms of activity, a mediate interest may be provided to reinforce the immediate.

Perhaps the hardest part of study is getting started. The dread of the task postpones its undertaking, and but adds to its unpleasantness by creating an unfavorable mood toward it. Let us teach and urge our pupils to plunge in immediately, and not stand shivering on the bank. Begin at once by doing something, and the more active it is the better it will bring the mind to attention. It takes time to "warm up" to the work, and this activity will help to hold the attention during this warming-up period.

But attention is a fickle servant, and is prone to go on strike on slight provocation. Fatigue is its favorite pretext for quitting, and in such case there are two courses open. If possible, drive it back to its task, in the hope that it will "get its second wind," and will quite forget if not negate fatigue. Too long concentration, however, will so far fatigue as to render attention impossible. Forcing study when the brain refuses to respond is not merely useless but harmful, since it unnecessarily exhausts the nervous system and engenders an attitude of distaste for the thing studied. A better method is that of laying the work aside for a time, and then returning to it later, refreshed in mind and body.

Viewing the process as a whole, training the pupil to study is essentially a six-step procedure.

1. Use good methods of thought in the class exercise.
2. Make the student conscious of these methods as such.
3. Show him how he can adapt these methods to his own needs.
4. Secure favorable conditions for study.
5. Guide him in the initiation of good methods of study.
6. Insist on results which only good methods of study can secure.

The fifth of these forms the topic for the following paragraph.

3. Supervised Study

Meaning of Supervision.—Supervised study as the term is now employed is primarily a plan for teaching to study.

The placing of a teacher in charge of a study hall to maintain order and, when able, to help pupils over obstacles in their study, has long been a common practice. Supervision of study, however, converts the teacher in charge from a mere police officer into a real instructor. Instead of a single teacher being called upon to assist pupils with difficulties in history and physics and Spanish and domestic science, it means that each teacher concerns himself with the preparation of the lessons he has assigned. Instead of urging students to study, telling them how to get desired answers, and doing their work for them, or too often confessing ignorance of the subject, supervised study implies teaching the pupils how to do their own tasks, helping when needed, and throughout it all carrying out the purpose involved in the assignment.

Investigations have demonstrated the advantages of supervised over unsupervised study.[1] It extends the classroom instruction into the study hour, adapts it to individual needs, and directs the formation of correct habits of study, as well as enables the teacher to watch the results of his teaching and to supplement the instruction as needed. Moving about among the class, he is able to render needed assistance in the attack upon the lessons, to redevelop and clear up with individual students points not fully grasped in the class exercise, to make supplementary assignments to those who find the regular assignments too easy or whose study raises questions for special investigation, and in short to effect individually the training discussed earlier in this section. Occasionally he may discover that some point in the lesson is causing difficulty for the whole class, in which case the study may be interrupted and a further general discussion or development of the difficult point may be introduced before further study is attempted.

[1] *Cf.* Breslich, "Thirteenth Yearbook of the National Society for the Study of Education," part I, pp. 32 *ff.*; Judd, "Psychology of High School Subjects," chap. XVIII; Parker, "Methods of Teaching in High Schools," chap. XVI.

The form and character of the supervised study must necessarily depend largely upon the subject matter. It is in many ways more exacting than the classroom instruction, offering constant temptation to tell rather than to instruct, to encourage dependence rather than to develop initiative. Probably it is no exaggeration to say that there are many teachers who know how to teach classes but few who know how to supervise study. High school teachers should be encouraged to find out how their students really study, instead of shifting responsibility or assuming that the study is as well done as could be expected. Most of our secondary school-teachers and administrators have yet to learn that instruction includes both class exercise and lesson study.

Administration.—For the administration of supervised study, no single plan has been generally accredited, though several have been tried with a goodly degree of success. One plan which observation and personal experience have commended to the author is what is known as the divided period. As employed in many high schools, the period is extended to sixty or eighty minutes, the first part of which is devoted to the regular class exercise, and the latter part to supervised study, with no fixed distribution of time, the lesson assignment shading off into lesson study as the teacher may find expedient. The marked advantage of this plan is the intimate connection between lesson development, assignment, and study. Even though but twenty minutes of a sixty-minute period be left for supervised study, the author has found this of great value, because the greatest need for supervision is at the beginning of the lesson study, and the very shortness of the time makes the class realize with added force the importance of losing no time in attacking the lesson and catching the essential principles while the teacher is at hand to render needed assistance. Another plan is the provision for one supervised study hour each day, the schedule allowing for each subject one hour per week; *e. g.*, history on Mondays, mathematics on Tuesdays, etc. Other devices for

study supervision are the conference or office hour, the study coach, and the unassigned teacher. Various other plans have been devised, most of them essentially similar to those mentioned.[1]

In general, it may be said that the progress made by classes after first introducing supervised study is somewhat slow, but that as the class adapts itself to the system, the subsequent gain more than offsets the first loss. This is, of course, to be expected, since the initial acquisition of power has necessarily a slower tempo than its subsequent application. Objection, too, has been raised that the supervision of study is expensive, making demand upon more of each teacher's time and effort. Experience seems to indicate, however, that such expense is ultimately less than is usually supposed.[2] Moreover, if account is taken of increased efficiency as well as increased pay roll, it is a safe presumption that the plan is an economy rather than an extravagance, since it is so much a higher rate of return on the investment. With the development of more effectual and possibly more economical administration, it is reasonable to expect that another decade will see supervised study the rule rather than the exception in our better high schools.

4. Summary

Study is the school's best means for developing initiative and self-control of students.

Good teaching is the basis for good study, which is essentially self-teaching. The pedagogical principles which hold in recitation, in lesson development, and in expression-application are the principles of study. The teacher must make the pupil conscious of the methods of learning in the class exer-

[1] The general subject of the administration of study supervision in secondary schools has been well treated by Hall-Quest in his book bearing the title "Supervised Study."

[2] *Cf.* Minnich, in *School Review*, vol. XXI, p. 675.

cise, and must by guidance and favorable conditions help him to make these the methods of his study.

Supervised study provides such assistance under various forms of administration.

QUESTIONS FOR DISCUSSION

1. Prepare a statement of all the arguments for and against home study by high school pupils.
2. Why do not teachers more quickly recognize the need of teaching pupils to study?
3. What are the symptoms that show that pupils do not know how to study?
4. Suggest some typical assignments that call for the accomplishing of results instead of for the doing of specified things.
5. Would it be well to dictate to pupils suggestive outlines for the organization of lessons to be studied? If so, how long should the practice be continued?
6. Is it better to tell pupils in what books to find needed information, or to let them find out independently? Why?
7. Should pupils be encouraged to seek information and assistance from teachers other than the teacher of the subject?
8. In showing pupils how to adapt the class-exercise method of attack to their study, would it be better to do so when the specific topic is developed in class, or to give them occasional instruction on the use of such methods in general?
9. What are the advantages of having pupils keep a file of the papers they prepare as home-study exercises?
10. Observe your routine of work and study for one or two days, and see what conditions surrounding your study are favorable, what are unfavorable. How far are you able to concentrate your attention despite bodily discomfort? Despite distracting environment? How much time do you waste getting started?
11. Into what dangers is the inexperienced teacher most likely to fall when undertaking the supervision of study?

SUPPLEMENTARY READINGS

Strayer, "Brief Course in the Teaching Process," chap. VIII.
Rickard, "High School Students' Description of Their Methods of Study," in *School Review*, December, 1915.
Giles, "Investigation of Study Habits of High School Students," in *School Review*, September, 1914.

Zimmers, "Teaching Boys and Girls How to Study."
Earhart, "Teaching Children to Study."
Hinsdale, "Art of Study."
McMurray, "How to Study and Teaching How to Study," especially chap. XI.
Parker, "Methods of Teaching in High Schools," chap. XVI.
Colvin, "An Introduction to High School Teaching," chap. XVII.
Starch, "Educational Psychology," chap. XXII.
Judd, "Psychology of High School Subjects," chap. XVIII.
Kitson, "How to Use Your Mind."
Whipple, "How to Study Effectively."
Bolton, "Principles of Education," pp. 262–280.
Johnston, ed., "Modern High School"; chap. X on "The Direction of Study as the Chief Aim of the High School," by Hall-Quest; and chap. XI on "Social Value of School Study vs. Home Study," by Wiener.
Hall-Quest, "Supervised Study."
Roberts, "Supervised Study in the Everett High School," in *School Review*, December, 1916.
Rapeer, "Educational Hygiene," chap. XXX.

CHAPTER XIII

LESSON ORGANIZATION

1. Significance of Organization

In the preceding chapters the work of instruction has been treated as falling under five modes, each fairly definite in character, yet frequently not distinguishable from the others, and at times overlapping upon them. The attempt has been made to show that any step in the regular instruction of the secondary school can be viewed as one or more of these five modes, and it was further seen that the instruction was usually more effectual because better adapted to a definite aim when each step was undertaken principally or wholly as a single mode. At the same time, however, the teacher must not lose sight of the fact that these steps are not units in themselves, but are merely parts of the greater whole, the elements out of which the lesson as a unit is to be built up.

In the same way, and for the same reason, the modes are not methods, but the components of methods. The method involves a selection and combination of modes, with the various components in varying proportion, and with a variety of content. Method is thus not mechanical or rigid, but is infinitely various, as its components may be variously chosen, combined, and accented. *Good* method is that in which the modes are so chosen and combined as best to accomplish the particular aim of the lesson, an aim which the subject matter as well as the child's needs must determine.

Recognizing the fact that the term "lesson" is to be applied not merely to the material to be taught but as well to the teaching of it, it follows that the organizing of the lesson with a view to teaching it involves the synthetic application of all the principles of instruction, and as such lies at the basis of all effectual teaching.

2. The Lesson Plan

Importance.—A well-executed purpose demands a well-formed plan. The teacher, preparing for the class exercise, must do more than know his subject matter and trust to inspiration for his method, for inspiration is a fickle servant, frequently blundering, and more frequently off duty. The preparation of an adequate lesson plan demands much pains and time, but without it teaching is prone to deteriorate into school-keeping. At the risk of repetition, it will be worth while to suggest a few fundamental principles which may aid the teacher in formulating his lesson plans and building up his methods of instruction.

The heart of the lesson is the development. It is there that the new material of the instruction is brought home to the pupil, and the other modes, recitation, expression-application, and laboratory, are for the sake of rendering the content complete, usable, and permanent. It is there that the planning of the lesson must therefore begin.

Lesson Aim.—Naturally a definite lesson aim must be determined at the outset; one to which the content is adapted and which fits in with the preceding and succeeding lessons. Taking account of the aims suggested in Chapter III, and of their special application to the content of the lesson, the teacher must ask himself: "Just what is to be the product of this lesson? How is it to function in the development of my pupils, in view of what they have learned and are to learn?" Nor should we forget that the aim of a lesson is not wholly determined by its content. The same problem or topic may for different teachers, with different pupils, and in different contexts serve quite different purposes, depending upon choice of material employed and method followed.

Content.—Thus, the second step in the organization of a lesson might be the selection of the content to be employed in its treatment. This involves far more than the collection of all available material bearing upon the subject. Nearly

always there is far more material which is relevant and in itself good teaching material than can be used. Moreover, much that is excellent must be sacrificed for something inferior in quality but better adapted to specific purposes. However, the lesson plan must not discard such, but include it as a kind of reserve, to be drawn upon if demanded by some unexpected situation in the class exercise. The want of such material restricts the teacher to the one anticipated procedure, often at the sacrifice of the spontaneity of the class.

Next, the thought must be organized. Logical and psychological organization are two very different things, based upon subject matter and student mind respectively. In the teacher's own study, the logical organization is the first step, since he must thereby gain an adequate conception of the bearings and relationships of ideas involved, and of their relative importance. Then, however, he must reconstruct the whole from the viewpoint of the learning process. It must be reorganized in the form in which the student, knowing what he does, can most naturally proceed in the lesson development. Here each point should be distinct, allowing for a step-by-step procedure, and should have a real function in the realization of the lesson aim, including the point or points to be made by the development. Here the teacher should not lose sight of the fact that what is organic to him, as its organizer, may be confused and disconnected to his pupils, who lack both his viewpoint and his power of analysis. How much of our teaching fails because our students do not see the seemingly obvious organization of our points! Provision must be made for such variations of plan as the classroom development may demand, yet with the limitation that such variations should be of procedure rather than of aim, and should not occur unless the advantage secured by the change more than exceeds that of following the plan for which preparation had been made.

Questions.—Lesson development implies student activity and participation. It must always proceed from a conscious

want to its realization, and the rendering conscious of such wants is the function of the question. The formulation of stimulating questions, well aimed and expressed, is far from easy, and should not be left wholly to the inspiration of the class exercise. Such questions are the product of study and thought, to which the varied demands of the class exercise are not conducive. While it is true that the course of the lesson thought cannot be wholly anticipated, it is none the less true that those questions whereby new topics or lines of thought are introduced are to a degree independent, and can usually be prepared in advance. Such might be called "pivotal questions," and upon their formulation the trend and the success of the lesson development largely depend.

Expression-Application.—To the problematic, and still more the appreciation, mode of development the expression-application mode is so closely related as often to overlap them, and in a measure to appear throughout the entire class exercise. However, this should not result in the expression-application being neglected or wholly absorbed by the development or recitation procedure. Not infrequently it may occupy a considerable portion of the class hour. On the other hand, its position at the close of the period subjects it to the danger of being prematurely terminated. Lesson development necessarily requires time; usually more time than the beginning teacher expects. Accordingly expression-application must be given a real and definite place in the lesson plan, and specific provision should be made for the details of its procedure such as in board or seat work, or class discussion.

Assignment.—The lesson assignment is the connecting-link between two class exercises. It determines almost wholly the plan of the next day's recitation procedure, as well as the student's independent study outside the range of the teacher's direct influence and aid. Once made, it must abide. The teacher in planning the assignment must, therefore, see it through in its entirety, anticipating and measuring its difficulties and planning both the form and the amount

of the assignment with these in view. Before the assignment is made, he must himself, ideally if not actually, prepare the lesson he proposes to assign, constantly asking himself regarding the pupil's fitness to do intelligently what is required. Is this process, this knowledge, this concept already in the pupil's possession? Has he access in his home study to the sources, references, and materials involved? If not, the need for such must be met in making the assignment, so that, undertaking his lesson preparation at home, he will not encounter a need which blocks or hinders his preparation. How long will it take, not the teacher but the pupil, for the preparation of such a lesson?

Recitation.—The day following the assignment the recitation mode completes the cycle of thought which began with the preceding development. It must, therefore, really complete it, so that further reference to its content occurs only as a review or as a part of the development of further content. This may therefore involve, especially in mathematics and the languages, the extension of the recitation procedure through the entire hour or even longer. In such prolonged recitation procedure there should be a degree of advancement in thought, with an increasing degree of complexity and implication, to secure both broader interpretation and continued interest. The recitation mode is, in a way, a reconstruction of the previous development. Yet because of its being a *re*construction, most of the background and details, the scaffolding of the original construction, will be omitted. It may also recall data of previous study, for purposes of review, for connecting it with the new material just studied and to complete the foundation for the new lesson development immediately to follow.

The recitation mode has, as we have already seen, a twofold reference: as a reciting upon the previous day's assignment, and as a propædeutic for the development of the day's lesson. The preparation of the lesson plan, therefore, must take account of these two functions. In the first place it

must recall the lesson developed on the previous day, with the assignment and its application, and must provide for adequate drill and test upon it as well as for its amplification and enrichment as needed. Problems and lines of questioning must be devised which will, without going into detail, probe for the vital points in the previous lessons and draw out the student's expression upon them. Secondly, the teacher must scrutinize again the plan for the day's development procedure, looking for all points wherein the products of the pupil's previous study are presupposed. Then, in so far as opportunity offers and occasion justifies, he must make provision in the recitation procedure for the refreshing of the pupils' memory and power as involved, thus realizing the propædeutic function of the recitation. In most cases, with well-organized subject matter and a logical sequence of work, these two phases of recitation procedure will blend naturally, since the best preparation for the development of the new lesson will be a recitation upon the old one.

Laboratory.—The use of the laboratory mode does not necessarily mean a distinct procedure under that name. It may be a part of the lesson preparation with the students working in library, laboratory, museum, field, or even at home. For high school pupils, especially in the sciences, care must be taken that the laboratory work does not cleave off from the classroom work and become for the class a course by itself, only remotely related to the class exercise. As we have already seen, it may even, as in Domestic Science, form a large part of the class exercise itself.

The lesson plan, therefore, must see each unit of content through its entire course from its development, through its expression-application, its laboratory (if involved), and its recitation, and must even make provision for its merging into the development of the next content. In this way the work of instruction is rendered organic and unitary, and for the student, as well as the teacher, the course does not disintegrate into an accumulation of unrelated facts.

Organization and Unity.—Thus, a lesson plan might well include such elements as a well-formulated aim, an outline of the thought and method of the recitation, development, and application, with the pivotal questions and occasional summaries to be employed in them, supplementary material and references which may be of use, and the proposed assignment. In the plan, especially in the recitation procedure, it might be well to indicate those points upon which it is intended to assist or question individual students as knowledge of their particular needs and capacities has shown it desirable. Without sacrificing elasticity and adaptability in procedure, the teacher should have a fairly definite idea of the form and distribution of activity, such as questioning, seat work, and board work, and of the distribution of time in the class exercise, as based upon the relative importance and the teaching difficulties of the various parts of the lesson.

Young teachers often ask that an illustrative lesson plan be shown them to pattern from. The author's experience, however, is that with such plans suggested there is often too much patterning at the cost of originality and suggestion. The lesson plan is merely one's formulation of his intentions; it is peculiarly personal, and will vary widely with different teachers and different subject matter. In the Appendix the reader will find the plans of a few lessons, some of which the author saw employed in the schoolroom, and which may serve to suggest to the inexperienced teacher how the principles suggested above may be applied. The teachers who prepared the plans were not perfect teachers (none such exist), but the plans suggested have at least the merit of being taken from the high school classroom, instead of from the professorial chair.

The thought which we have endeavored to emphasize throughout the preceding pages is that of freedom and individual initiative on the part of the teacher, yet an intelligent freedom based on a knowledge of the materials he uses. If, as he paints, the artist-teacher occasionally steps back and

views the work he has done, the results of his efforts and experiments, and strives ever to remedy defects and broaden his field of endeavor, he will acquire skill in mixing his pigments and applying them for the realization of his design. Knowledge of the pigments and a few fundamental laws of color-mixture we have endeavored to supply. The design must be his own.

3. Summaries in the Lesson

Importance.—The organization of a lesson is far more obvious to the teacher who organizes it than to the student who sees only the lesson after its organization. The summary, mentioned on page 253, is essentially a condensed restatement or skeleton of the material in such form that its organization and perspective are rendered obvious and definite to the student. At the same time, it serves as a kind of review of what has just been treated, thus securing greater permanency of its acquisition.

The summary thus serves as a most effectual teaching device in the recitation, and even more in the development. For the student it converts a mass of data into a systematic unity, with each part significant in the plan of the whole, and the incidental distinguished from the fundamental.

Requirements.—It follows, therefore, that the good summary shall contain only essentials, rather than details, its points shall be really significant statements rather than paragraph titles, and that these shall be so worded as to impress the central thought directly and clearly upon the student's mind. Its logical place in the lesson will be at the completion of a large and complex unit of thought, surely at the completion of the development procedure. A development which does not culminate in a summary is in grave danger of disintegration and loss.

In so far as possible the lesson summary should be the work of the class rather than of the teacher. While the

latter should have his own summary in mind, his purpose must be to develop a summary with the class, thus training them in evaluative judgment as well as in orderly thinking. Moreover, a summary which they have helped formulate will be far more easy to remember. Having in mind his own summary, doubtless more complete and logical than theirs, he is to assist his pupils by question and suggestion only in so far as they of themselves fail to secure adequate results.

Naturally, in the development of a summary, the blackboard will appeal strongly to the teacher, since it facilitates the showing of relationships. Finally, when completed, the summary in its approved form should be copied by the pupils in suitable notebooks, to be of service to them for subsequent study and reference.

4. Review and the Review Lesson

Character.—The foregoing paragraphs have had special reference to the typical lesson in which new material forms the central and dominating part. There is, however, another type of lesson or lesson procedure which deals primarily and almost wholly with material already studied. Such is the review, whether as the review lesson or as the review procedure as a part of a lesson. Moreover, in well-ordered teaching the review lesson will play a small part indeed, since the review activity should function largely in nearly every lesson. It has already been shown that it is better to revive memories often, even though briefly, than to do so at long intervals, however intensively. And true review as thus conducted is more than a revival, it is also an expansion and reapplication. Whenever the teacher plans the work for any period of time, he must take account not alone of acquisition of new power but of conservation of that already acquired. He must ever seek to build the old into the new, and to utilize it in the mastery of the new. This constant renewal and broadening

of material through its expanding place in the whole is the best kind of review.

Yet the review lesson also has its place, because of its broader range and opportunity for organization. Its mode is that of recitation, frequently combined with application. Usually it differs from the recitation procedure of the typical lesson in that its content is derived from a much larger field and longer period of study, although conducted similarly to it. It is largely because of this difference of scope that it has to a peculiar degree the added function of organizing the lessons previously studied, while sharing with the other the purpose of insuring permanency of retention.

Requirements.—From the nature of a review, it is obvious that only the essentials of its content can receive attention. A review exercise must necessarily pass over the details. This does not mean that they shall be taken for granted, but rather that the essentials shall be so dealt with as to presuppose and demand a knowledge of detail. This is due not so much to lack of time as to the importance of selecting and setting forth the more fundamental principles and significant facts, not in isolation but in an organic unity. Too often, in the study of new material, the necessary attention to particular facts and details of procedure cause the student to lose his perspective of the relationship and significance in what he is studying. The review lesson or exercise offers the opportunity for the organization of this otherwise unorganized material.

With this conception of the organizing function of the review, it is evident that the frequency of the review lesson is to be determined not by the calendar but by the content. Naturally, the time to review is upon the completion of a unit of thought, for then only can one realize the significance both of part to part and of the whole to other lines of thought.

Review is more than reciting. Merely recalling what has been retained or revived by special study does not fulfil this broader function of review. It demands the active co-

operation of the teacher in the pupil's thinking, leading him by question and suggestion, even by supplementing his knowledge, to discover the broader meanings hitherto unnoticed. This means, then, that merely giving a written test upon work previously studied, however valuable in itself, must not be called review. The review may well culminate in a test, but the test is not a review.

5. Summary

The lesson plan should include a well-formulated aim, a carefully selected and organized content, an appropriate lesson development and application, introduced by a recitation which connects the past study with the new lesson, and a definite assignment. Pivotal questions should be formulated for the introduction of topics and lines of thought. Provision should be made for the form and distribution of the lesson activity at each step, in so far as possible without sacrificing freedom of adaptation and initiative.

At the completion of units of thought in the lesson, the class should work out summaries, thus securing organization of thought as well as deepening of impression.

The review, dealing with old material, should serve not alone to secure permanence of acquisition but more especially better organization of content. Its frequency should be determined rather by subject matter than by time intervals.

QUESTIONS FOR DISCUSSION

1. What practical difficulties will result from making the written lesson plan too detailed? From making it too general (leaving too much to memory or inspiration)?
2. Will pupils lose confidence in a teacher when they see that he uses a written lesson plan?
3. Is it wise for the teacher to be seen to read his pivotal questions from his written lesson plan? Give reasons.
4. Mention the advantages of keeping a permanent file of all lesson plans used.

5. Prepare several lesson plans in accordance with the principles suggested.

6. Watch some good teacher and see if you can make out his lesson plan from his teaching.

SUPPLEMENTARY READINGS

Dewey, "How We Think," chap. XV.
Strayer, "Brief Course in the Teaching Process," chap. XVI.
Parker, "Methods of Teaching in High Schools," chap. XXI.
Colvin, "An Introduction to High School Teaching," chap. XVI.
Bowman, "The Lesson Plan for Inexperienced Teachers," in *Industrial Arts Magazine*, September, 1916.
Twiss, "A Textbook in the Principles of Science Teaching," chap. V.
Whipple, "Guide to High School Observation."

CHAPTER XIV

STANDARDS AND MEASUREMENTS IN INSTRUCTION

1. Efficiency in Teaching

The Need for Measurements.—A merchant who kept no account books, who never prepared a balance sheet or took an inventory would in our present economic world soon experience bankruptcy. The successful business man of to-day is constantly submitting each department and method of his business to careful scrutiny, applying everywhere tests and measurements to assure himself that his entire system is actively contributing to the desired results.

Sooner or later the tree is to be known by its fruits, and the teaching profession has within a decade awakened to the applicability of this principle in the educational world. Hitherto, too much has been taken for granted, too little has been scrutinized for results. The peculiar professional character of educational work and the long interval of time between education-getting and education-using has shielded the teacher from the responsibility for the products of his labors. In consequence, he has assumed that the absence of direct criticism from without means successful procedure, and he has satisfied himself with that procedure accordingly. The examination system has been utilized as a test of the performance of individual pupils, but with rare exceptions the teacher has never noticed that even this inadequate exercise was also a partial measure of the instruction. Moreover, when the instructor prepares the examination questions for his class and is the sole authority in the grading of the answer papers, he has no basis for the evaluation of their performance as compared with the work of students under other instructors.

Unfortunately this complacency is ill-grounded. Our methods of instruction are largely the result of imitation, too often we have lost any consciousness of aim which may have functioned originally, and mere inertia is all that serves to perpetuate them. The layman does not challenge them because of recognized incompetency, the supervisor often lacks the time and skill to criticise, and the instructor himself is too intimately involved in the procedure to pass judgment upon it. The need is for standards which are sufficiently objective and impersonal for the instructor to employ in measuring his own work, and which are general enough to render possible a comparison of the work of many individuals.

Scientific method takes nothing for granted. No more should instruction, especially if it would lay claim to being a science. It is but natural that the teacher should assume the success of his efforts when their failure is not forced upon his attention. Partly for fear of displaying ignorance or dulness, partly for fear of seeming to imply poor teaching, partly from a disposition to follow the line of least resistance, pupils do not tell the teacher that his efforts to teach them have not succeeded, but instead there is a tendency for the students to appear to have succeeded and for the teacher to credit such appearance unquestioningly. Day by day, the pupils turn in reasonably correct answers to problems, and the teachers do not challenge the thinking whereby the answers were obtained. Thus, pupils come to regard the situation as normal, and the instructor becomes increasingly credulous and uncritical. What is needed is some kind of indicator which will serve to report to the teacher that his efforts are not meeting with the success desired, and to develop in the student the habit of insisting upon the mastery of work undertaken.

Wise business management requires every department of the business to show that it is making each dollar and each hour invested bring in the maximum return. Considering the enormous outlay in money and labor expended in the

work of teaching, it is highly important that there too the highest possible efficiency be attained, and the element of waste be reduced to a minimum. The teacher who accepts the commission of converting these resources into educational products thereby implicitly undertakes to employ only the most effectual methods, and must accordingly be on the watch for any device for the recognition and employment of superior and economical modes of procedure.

Advantages to be Gained by Measurement.—Because of the absence of an external challenge upon his work, because of the tendency to take success for granted, and because of the obligation to secure maximal result from the resources provided, the educator is in need of suitable standards for checking up and evaluating his work through its results. These requirements, which apply to the entire educative activity, whether administrative or instructional, suggest several ways in which the special field of instruction would derive benefit from a suitable system of standardization and measurement of teaching products.

In the first place, an adequate evaluation of personal accomplishment would be facilitated. For purposes of the grading and promotion of individual students, a standard would be provided whereby to adequately rate his attainments. Under the prevailing system the instructor has no accurate method of evaluation. Examinations are at best only fragmentary; class grades do not represent ultimate achievements of fitness for promotion. Too often the things which the instruction is designed to secure are not made the basis for ranking of the pupil's achievement. Moreover, it is not enough to know where the student stands at a given point of time. Quite as important is it to know just what progress he has made in a given period of time. Thus, by measuring his achievement at regular intervals, it is possible to determine what his progress has been, and whether he is gaining ground as rapidly as is expected or might be desired. Nor is the application of standardization limited to individual stu-

dents. Immense value comes from a comparison of work, between classes and between institutions. Both teacher and supervisor should be able to determine whether the work of a class measures up to a standard which might reasonably be expected of it, and such standard is naturally determined by a comparison of the work of many classes and institutions and instructors. Thus the value of a standard available for the evaluation of achievement would obviously be great.

A second value, and one which concerns us peculiarly in the present study, lies in the opportunity afforded for the reliable evaluation of various teaching methods. Day after day, year after year, we follow a settled plan of instruction, confident that it is effectual, but without justification for our confidence. Or, if two alternative methods occur to us, we are prone to select the one which *looks* the better, but without positive knowledge of its superiority. In either case, the only adequate procedure is to test for products, and to let the result of our testing determine our choice of further procedure. The old method of memorizing a poem line by line was generally accepted as the best until an experimental test established the superiority of learning by much larger units. For the determination of the value of methods and the selection of the most effectual there are needed established standards of comparison and methods of measurement if conjecture and custom are to give way to certainty and progress.

Finally, scientifically applied methods of testing are of inestimable value in discovering the peculiar needs and talents of individual students. Class instruction tends to produce a collective attitude on the teacher's part in his treatment of the class. While it is wise and necessary to employ much the same method of instruction for all members of the group, it is equally important that the individual needs of the students be recognized and met in the employment of the method, and the knowledge of such individual needs can best be obtained by well-planned, scientifically devised tests and measurements.

The need and value of such standardization is to-day gaining general recognition among educators, but as yet comparatively little has been accomplished in the supplying of that need. The problem is a most difficult one, and what little has been done toward the solution has been restricted largely to elementary education. This does not mean, however, that the secondary school teacher need not concern himself in the matter until scientists have completed the task of standardization. Rather he must be familiar with the essentials and the application of standards so that when they are proposed as they are bound to be soon, he will be able to employ them discriminatingly and effectually. At the same time, there is much that he can do by way of improving what tests he is already employing, and rendering them more significant, and interpreting better their results. Finally, he may actively participate in the work of formulating standards, even in a humble way, by studying carefully the aim and essentials of educational measurements, and trying out such simple tests as seem to him helpful and significant.

2. Essentials of Standardization

In the commercial world, standardization has been and is being carried into all the fields of intercourse. There are standards of length, of weight, of value; standard sizes of builders' materials, standard weight of the bushel, standard strength of chemical solutions. Efficiency in education, as in commerce, demands the establishment of educational standards, as the preceding section has already shown us.

Essentials in Measurement.—What is a standard? In view of its obvious purpose, the facilitation of comparison between individuals and groups with regard to some specified feature, we find five essentials which any standard, in education as well as elsewhere, must possess. These we shall call objectivity, definiteness, absoluteness, inclusiveness, and

practicability.[1] A brief discussion of each seems to be called for.

By the term "objectivity" of a standard is meant its freedom from personal bias on the part of the one employing it. An objective standard is one which conveys the same meaning to all competent observers. The hour, the meter, and the degree are thus objective standards. On the other hand, such assertions as "this problem is as easily solved by algebra as by arithmetic" involve a purely subjective standard, since what is easier for one pupil is often more difficult for another.

The term "definiteness" needs but little explanation. A standard, in order to serve as a basis for measurement and comparison, must have an exact meaning. When there is uncertainty as to its interpretation, when the observer can read into it anything except a single meaning, it loses its value as a standard. The tables of measurement and the established standards of the commercial world mean, everywhere and always, an exact and permanent value. The proverbial recipe which calls for "a pan of flour, a small cupful of sugar, and a little salt," involves, for the uninitiated at least, anything but a definite standard of measurement. "A reading knowledge of French" as a requirement for advanced study is well known to admit of widely varying interpretations because of its indefiniteness.

Absoluteness, the third essential of a good standard, suggests the idea of independence and fixity. An absolute standard is one whose value is not dependent upon some changeable factor, but is always the same because it is free from variable conditions. The absoluteness of the meter as a standard is insured by making it the length of a certain metal bar in Paris, at a specified temperature. The ability to spell all the words in "Thanatopsis" would constitute an absolute standard, though doubtless one of little educational value. On the other hand, the ability to spell the best in a

[1] *Cf.* Thorndike, "Mental and Social Measurements," pp. 11–18.

class of sixth grade children would not serve for a standard of spelling ability, for in another sixth grade the superiority in spelling might mean a higher or a lower degree of efficiency.

The fourth essential is inclusiveness, both of range and of gradations. In careful measurement, we never lay down our walking-stick and say, "the room is seven times as long as the stick," or "the line is four-fifths of the length of the stick." It is an established psychological principle that the most accurate judgment is of equality, and that the estimation of considerable differences and of relative amounts is exceedingly inaccurate. So, in measuring, we choose a measure at least as long as the line to be measured, and seek to find some known length on the measure just equal to the length of the line measured. In like manner, if we wish to measure the spelling efficiency of a number of children, we require a standard scale of spelling performances extending at least to the quality of the best performance in the group, and including already evaluated performances approximately corresponding in quality to the performances of the various children.

The fifth requirement, practicability, involves the workableness of the proposed standard in the measurement of the various things for which it is intended. Miles or kilometres are far more practicable than inches and centimetres as standards for geographical distances. Ability to image the scenes described would not serve as a standard in measuring historical study, since it would be impossible to know or to calculate the results secured.

Measurableness.—But the possession of a suitable standard is not all of measurement. There are certain principles which govern in the method and the range of its application. In educational work especially, the complexity of both material and standard and the comparative newness of the field demand no small degree of caution in the application of measurements, and efforts to measure that which in the present development of our method is incapable of measurement are common but unfortunate.

What can be measured? The answer lies in the nature of measurement. When we wish to know the length of a garden, we provide ourselves with a standardized length in the form of a tape measure, and by comparison determine the standardized length on the tape measure which (as nearly as possible) matches the length of the garden. The result constitutes the dimension of the garden. The same principles and method hold in educational as in linear measurements. In the first place, our measurement of the garden demands a standard which can be used for the entire distance measured. If the garden is crossed by a high wall so that the tape measure cannot be accurately used, our efforts are thwarted. The further requirement, closely related to that just mentioned, is that the terminal points of the measurement be accessible. If one end of the garden is completely inaccessible, measurement would be impossible.

Educational measurements demand the same conditions, viz., an applicable standard and accessible termini of measurement, and only those things can be measured wherein these requirements are met. As yet, applicable standards for educational measurements are very few, and most of these are applicable to elementary education only. Extreme difficulty is experienced in the formulation of standards which meet the five requirements mentioned at the beginning of the present section. In the evaluation of students' achievements, it is hard to find standards such that all observers employing them will give the same judgments. Definite standards such that the meaning and values are unmistakable require great care in the formulating. Standards whose values are so well established as to be absolute and uniform for all times and conditions, materials and judges, are not readily devised. The securing, selecting, and ranking of a series of graded specimens of educational efficiency involves extended search and careful discriminating judgment. Much experimental investigation is required in the discovery of standards which can be readily and generally applied.

To say that the termini of measurement must be accessible means that we must be able to determine the location both of the performance as given for measurement and of the zero degree of such performance. We must really know just what the individual or group is presenting us; the thing we take to be the index of capacity must be truly indicative of that capacity. Measuring the capacity of the trained mathematician by means of a sixth grade examination paper in arithmetic would be futile, since the performance would not represent that capacity. His capacity can be measured only when we can employ a test the response to which represents the exercise of that capacity to its utmost. Moreover, the true evaluation of his achievement is possible only when we can say how much power it represents: how much better it is than no power at all, or the zero ability. When a stone is said to weigh five pounds, it means that it weighs five pounds more than nothing. The determination of the zero point in educational capacities is one of the first steps in standardization, and demands extensive experiment and calculation. At best, it is ultimately a matter of the judgment of many competent observers in which there is a reasonable degree of agreement.

Applications of Measurement.—What specific elements in secondary instruction can be measured? In terms of the aims of instruction, as mentioned in Chapter III,[1] there are five results which good instruction will effect and which the successful pupil will possess: knowledge, thought power, appreciation, efficiency in expression and application, and permanency. To which of these are the methods of measurement applicable? That suitable measurements for even a considerable number of them have not yet been devised we have already seen.

Knowledge seems evidently the easiest for which to test. One has but little more to do than to list the facts the pupil might be expected to know, and ask memory questions enough

[1] *Cf.* p. 30.

to draw out the desired information provided neither examiner nor pupil perish from exhaustion during the process. Indeed, it is the enormity of the amount of material rather than its inaccessibility that renders an adequate testing of knowledge impossible, and herein lies much of the basis for the criticism that an examination consisting largely of memory questions is largely a test of endurance and a matter of chance. As we come more and more to realize that the possession of information is not the final educational aim, the importance placed upon the examination primarily for knowledge diminishes.

The testing for thought power presents a more difficult problem. Some work has been done along the line of mathematical reasoning and the interpretation of reading content, and less in the field of judgment. For the power of imagination, no test has yet been devised. Naturally there is encountered difficulty in the formulation and application of an adequate standard, for it is not easy to say that two different thought problems are equally difficult for a student, or that the same problem represents the same capacity on the part of two different students. With any but the simpler forms of mathematical reasoning and possibly of judgment, the thought process is highly complex and individual, and depends largely upon the pupil's previous experience. In the case of imagination, the difficulty of measurement is much increased by the discrepancy between the imagery and its expression.

Appreciation is clearly the most difficult of all to measure. Like imagery, but to a much greater degree, it is so far removed from its expression as to be seemingly inaccessible. It is for this reason that many excellent teachers oppose the giving of examinations in literature, feeling that the examination would tend to overemphasize the knowledge element in the study, and would afford no measure of the vital element, the appreciation. It is of course well for the student to compare æsthetic situations as to their appeal to the observer,

but anything like a scientific measurement of that appeal and its response is as yet far from realized.[1]

Efficiency, as the student's ability to express and apply his experience, is necessarily a factor in all forms of testing. His knowledge, his thought, and his feeling can be measured only in so far as they can find expression and application. At the same time, it is often possible to grade students' performances as to efficiency in expression and application as distinct from the content expressed or applied. In composition work, the form of expression, including the selection of words and style of writing or of speech, may be evaluated. In practically all forms of scholastic work, the element of application can be investigated. In this latter case, the most work has been devoted to the standardization of skill in the application of rules and processes, such as the mathematical operations, the observance of grammatical and rhetorical principles, and the functioning of training in penmanship and reading. Speed and accuracy of performance play a large part in the measurement of application. However, the expression and application are but the form which the content assumes, and their measurement apart from that of their content, the knowledge, thought, and feeling, is difficult, if not impossible.

Of measurement for permanency, the last statement holds with equal validity. To measure permanency is but to measure the degree to which experience persists when once acquired. It is virtually a memory test, and involves implicitly an examination for all the other four instruction aims. While many investigations to determine the best methods of learning have been made, no standardization for it has yet been effected in the same way in which thought power and skill have been standardized. Doubtless as its importance is better realized it will receive more attention, for there appears

[1] *Cf.* "Tests of Æsthetic Appreciation," by Thorndike, in the *Journal of Educational Psychology*, November, 1916.

to be no inherent difficulty to prevent its measurement and standardization.

What has been said suggests a limitation to which the entire measurement problem is subject. The various activities are so intimately interwoven that a test for any one is at the same time a partial test for most or all of the others. The complete isolation of any one of them is impossible, so that the results obtained indicate more than the measure of some single element. For educational purposes, however, this is not a fatal difficulty, for the desired products of instruction are always compounds of these elements, and it is educational products alone which it is worth while to measure, whether in determining the educational progress of the child and his fitness for promotion, in discovering the most effectual methods of instruction, or as a basis for the comparison of individuals or groups. The importance of the consideration of the elements separately lies in the necessity for their recognition and consideration in the measuring.

That a real prejudice exists against the measurement and standardization of educational products is largely due to the complexity just mentioned, and the fear that measurements cannot be applied to them without failing to measure vital, perhaps the most vital, elements in them. It is felt by some that only certain minor phases of instruction are amenable to quantitative treatment, and that the attempts made tend to an overemphasis of these minor phases in educational evaluations. That such a danger exists is doubtless true. However, it must be remembered that the work of standardization is yet in its infancy, but is imperatively needed for the attainment of maximal efficiency in teaching. The results already attained are proving of inestimable value, and with a careful prosecution of the investigations and a proper evaluation of the results actually achieved, the teaching efficiency in our schools, secondary as well as elementary, will experience a real and inestimable advance.

3. Typical Standards and Forms of Measurement

The Two Kinds of Measurement.—The surveyor seeking to determine the elevation of a mountain must first know the level of the sea, which is to serve him as the zero elevation. Not that he must actually drill a hole into the earth until sea level is reached. But he must know how far down it lies; it must be ideally accessible, in order that the elevation of the peak may be measured from it. In the same way, the educational investigator, seeking to evaluate the student's proficiency, must know the zero point of that proficiency. He must either find or manufacture a specimen of work which is to represent just no proficiency at all of the type to be investigated.

Let us, however, conceive of a surveyor who for some reason does not know and cannot find the sea level. Evidently he cannot determine how many feet high the mountain peak is, but there remains something which he can do which may prove of real value. He can form a comparison of the given peak with neighboring peaks. So the educator who cannot determine numerically just how much a student's performance is better than zero may still give it a rating in terms of the work of other students of the same age or class.

Thus we have two types or grades of measurement. In the one, the comparison is made with a known zero point, above which the performances of students are rated in terms of absolute value. This, of course, is the ideal measurement. In the second type, the comparison is made solely with the achievements of other students, and all that can be determined is relative merit. Obviously, this is far inferior to the former type as regards scientific exactness, mainly because of the variability of the assumed standard, the work of other students. It is, however, far from valueless, and for some purposes its results may serve quite as well as those of the absolute standard, in the former type. The present section aims to give the reader a conception of the kind of work al-

ready done in the formulation of standards and systems of measurements of these two types. Although our interest is primarily in secondary education, the extremely limited degree of work yet done in that field and the overlapping between elementary and secondary education, especially in the junior high school, justify a brief treatment of some standardization already attempted in the elementary field.

Measurement in Various Studies.—The work done in the study of school children's handwriting will possibly be the simplest to explain and the most convenient starting-point for our treatment of the subject. As a standard for the grading of the handwriting of children of the four upper grammar grades (fifth to eighth), Professor Thorndike has prepared a scale (commonly called the Thorndike Scale), consisting of a series of specimens of handwriting representing various degrees of excellence, and each quality being numbered according to its position in the series or scale. The number of each quality in the scale is thus an index of its relative merit. Professor Thorndike's own explanation may profitably be quoted. "The use of 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, and 17 for these qualities of handwriting means first of all, that 14 is as much better than 13, as 13 is than 12; that 13 is as much better than 12, as 12 is than 11, and so on. In the second place it means that quality 14 is two times as far above 0 merit in handwriting as quality 7 is; that quality 16 is twice as far above 0 merit in handwriting as quality 8 is, and so on. Zero merit is defined roughly as . . . a handwriting, recognizable as such, but of absolutely no merit as handwriting. The use of several samples under one quality means that these samples are of equal merit. The scale includes samples of as many different styles as could be obtained, so that in using the scale the merit of any sample of any style of writing can be quickly ascertained by comparison with the scale. The scale extends in actual samples by children from nearly the worst writing of fourth grade children (quality 5) to nearly the best writing of eighth grade children

(quality 17). Quality 7 is nearly the worst writing of fifth grade children.

"The scale includes a sample of a copy book model which is rated by competent judges as of approximately quality 18, two samples of fourth grade writing which are judged to be approximately of qualities 6 and 5, and a very bad writing, artificially produced, which is rated by competent judges as of approximately quality 4. The scale thus extends from a quality better than which no pupil is expected to produce, down to a quality so bad as to be intolerable, and probably almost never found in school practice in the grammar grades."

"Any specimen of handwriting is measured by this scale by putting it alongside the scale, as it were, and seeing to what point on the scale it is nearest." [1] The derivation of the scale is a long and complicated process, and does not concern us in our present discussion. For an explanation of the process, the reader is referred to Professor Thorndike's account of it in the publication from which we have quoted.

The Hillegas Scale for the measurement of quality in English composition[2] is constructed on the same principle as the foregoing. Here again a series of samples of compositions is made the basis for evaluation, by comparison with which the composition to be measured is ranked. The following specimens taken from the Hillegas Scale will afford some idea of its character. The first sample is a purely artificial one, supplied for the purpose of providing a zero quality. The other samples here given are the work of high school students, of second, first, and third year classification, respectively.

Sample 580. Value 0.

Dear Sir: I write to say that it aint a square deal Schools is I say they is I went to school. red and gree green and brown aint it hito bit I say he don't know his business not today nor yesterday and you know it and I want Jennie to get me out.

[1] Thorndike, "Handwriting," in *Teachers College Record*, March, 1910.
[2] Hillegas, "English Composition," in *Teachers College Record*, September, 1912.

Sample 94. Value 369.

When Sulla came back from his conquest Marius had put himself consul so sulla with the army he had with him in his conquest siezed the government from Marius and put himself in consul and had a list of his enemys printy and the men whoes names were on this list we beheaded.

Sample 196. Value 675.

Ichabod Crane was a schoolmaster in a place called Sleepy Hollow. He was tall and slim with broad shoulders, long arms that dangled far below his coat sleeves. His feet looked as if they might have easily been used for shovels. His nose was long and his entire frame was most loosely hung to-gether.

Sample 221. Value 772.

GOING DOWN WITH VICTORY

As we road down Lombard Street, we saw flags waving from nearly every window. I surely felt proud that day to be the driver of the gaily decorated coach. Again and again we were cheered as we drove slowly to the postmasters, to await the coming of his majestie's mail. There wasn't one of the gaily bedecked coaches that could have compared with ours, in my estimation. So with waving flags and fluttering hearts we waited for the coming of the mail and the expected tidings of victory.

When at last it did arrive the postmaster began to quickly sort the bundles, we waited anxiously. Immediately upon receiving our bundles, I lashed the horses and they responded with a jump. Out in the country we drove at reckless speed—everywhere spreading like wildfire the news, "Victory!" The exileration that we all felt was shared with the horses. Up and down grade and over bridges, we drove at breakneck speed and spreading the news at every hamlet with that one cry "Victory!" When at last we were back home again, it was with the hope that we should have another ride some day with "Victory."

In the interpretation of the values assigned, the same principle holds as in the handwriting scale. For example, sample 221 is rated as a little more than twice as good as sample 94, and about seven-sixths as good as sample 196. "Merit in

English writing is complex. Judges are influenced both by form and by content. Such factors of form as spelling, punctuation, capitalization, and the like are subject to definite rules. Form is, therefore, more easily measured than content. When an individual is in doubt concerning the relative merits of two English compositions, the tendency is to fix upon some one or more of the obvious form elements, and for the time being to give them undue importance in fixing the relation of the samples.

"No attempt has been made in this study to define merit. The term as here used means just that quality which competent persons commonly consider as merit, and the scale measures just this quality. . .

"The value of any English composition may be obtained by placing it beside the samples constituting the scale and determining to which it most nearly corresponds." [1] Thus applying Doctor Hillegas's explanation to the samples given above, if the reader thinks the sample to be measured "is better than sample 196 but not as good as sample 221, he may place the value between 675 and 772. By this method the value of any sample may be expressed as accurately as the individual cares to make it." Unfortunately English composition is necessarily a very complex thing for evaluation; much more so than handwriting or drawing. The Hillegas Scale has been criticised on two grounds: lack of inclusiveness and lack of definiteness. Experience has shown that it is not sufficiently inclusive in that it lacks small enough subdivisions; that the intervals between the specimens constituting the scale are too wide to render possible the rating of the various merits of compositions that occur in practice. To meet this defect there has been issued the Thorndike Extension of the scale, wherein are included a larger number of specimens of different merit, and accordingly separated by smaller intervals. This Extension also seeks to remedy the

[1] Hillegas, "English Composition," in *Teachers College Record*, September, 1912.

other defect mentioned, the lack of definiteness, by placing in the scale more than one specimen for each quality, in order that the user of the scale may find in it a specimen similar in type as well as merit to the composition he would score.

Another effort to meet the demand for definiteness has been made in what is known as the Harvard-Newton Scale,[1] prepared by the teachers of Newton, Massachusetts, working co-operatively with F. W. Ballou, of Harvard University. This is virtually a set of four scales, including one in each of the four types of composition: description, exposition, argumentation, and narration. Each scale consists of six compositions, selected from the work of eighth grade pupils, and assigned score values according to the marks given by the teachers. They are so selected that the scores approximate forty-five per cent, fifty-five per cent, sixty-five per cent, seventy-five per cent, eighty-five per cent, and ninety-five per cent in each set. Each specimen is followed by a specific statement of its merits and defects, as well as of the bases for its superiority to the one below it, and its inferiority to the one above it, in the scale. In this way it is designed by specific statements to make definite the merits which the scale undertakes to measure. Both the Harvard-Newton and the Hillegas scales are rendering service in standardizing and making definite the evaluation of English compositions.

Possibly the best known educational tests are those designed by S. A. Courtis, and regularly known as the Courtis Standard Tests (Series B),[2] in the four fundamental operations of arithmetic. This series "represents an attempt to secure definite objective standards for each of the four operations with whole numbers—addition, subtraction, multiplication, and division." The following are typical problems:

[1] Ballou, "Scales for the Measurement of Composition," *Harvard-Newton Bulletin*, No. 8, September, 1914.

[2] Series A, dealing with arithmetical correlations, and Series C, dealing with English work, are little used. The best description of the tests is in Courtis, "Manual of Instructions for Giving and Scoring the Courtis Standard Tests in the Three R's."

927	75088824	8246	94)85352
379	57406394	29	
756			
837			
924			
110			
854			
965			
344			

In the test for each operation only a limited time is allowed the student, and the number of examples given is about twenty-four. Scores are taken for both accuracy and speed. The accuracy score is based upon the number of examples he can work correctly in the time allowance, which is too small for any student to work all. The score for speed is based upon the total number of examples attempted in the time allowed. Efficiency in the four fundamentals is thus measured in terms of both accuracy and speed, with the thought that by proper drill each be raised to its maximum without sacrificing a proper degree of the other in so doing. Both for the standardizing of arithmetical achievement and for the detection and remedying of weaknesses in the teaching of arithmetic, the Courtis Tests have rendered notable service.

In the field of secondary education, practically all of the tests so far devised have appeared within the past three or four years, and are necessarily tentative and almost untried, though of real service. To a considerable degree, the lack of standardized tests in secondary school subjects is doubtless due to the lack of agreement among teachers as to the educational products toward which the various high school studies should strive. Professor W. S. Monroe has worked out a series of Standard Research Tests in Algebra, which were probably the pioneers in the field.[1] We quote his description:

[1] Monroe, De Voss, and Kelly, "Educational Tests and Measurements," p. 228.

These tests consist of a series of six tests. Each of the first five tests is designed to measure the ability to do one of the operations occurring in the solution of simple equations. The tests are:

Test I, $\pm a\ (\pm bx \pm c)$, a, b, and c, being not greater than 9 and not all positive.
Test II, Clearing equations of fractions.
Test III, Solving for x, a special case of division.
Test IV, Transposition.
Test V, Collecting terms, a special case of addition and subtraction.
Test VI, Simple equations to be solved.

In giving the tests each pupil is provided with a printed copy of the exercises to be done. A definite time is allowed for each test. The ability of a pupil is measured by the number of exercises he does in a given time, and by the accuracy of his work.

These tests can best be illustrated by specimen problems:

Test I, Multiplication. $4(3x - 4) =$
Test II, Reduction to a Common Denominator.

$$\frac{5 + 6x}{12} - \frac{4x - 3}{15}$$

Test III, Division. $14x = 34$
Test IV, Transposition. $18 - 6x - 24 = -14x + 42$
Test V, Collecting Terms. $-8x + 40x - 3 - 8 - 32$
Test VI, Solving Equations. $\frac{4x + 5}{15} - \frac{2x + 3}{21} = 0$

A somewhat similar series, which the author calls Preliminary Algebra Tests, has been devised by C. Eben Stromquist. The following specimen problems from the five tests of the series will suffice to show the character of the series:

Test I, Addition. Add:

$$\begin{array}{r} +\ 2x^2 - 9x + 8 \\ -\ 5x^2 - 3x - 6 \\ +\ 11x^2 - 4x - 7 \\ \hline \end{array}$$

Test II, Subtraction. Subtract the second from the first:

$$\begin{array}{r} -\ 7a^2 + 11a - 18 \\ +\ 8a^2 + \ 3a - 23 \\ \hline \end{array}$$

Test III, Multiplication. Multiply:

$$\begin{array}{r} -3x^2 + 12xy + 5y^2 \\ 4x - 7y \\ \hline \end{array}$$

Test IV, Division. Divide the second polynomial by the first, placing the quotient above the line over the dividend:

$$5x^2 - x - 6\overline{)5x^4 + 9x^3 - 28x^2 - 8x + 24}$$

Test V, Factoring. Factor to simplest factors:

$$4x^2 + x - 33 =$$

Another series is that devised by Henry G. Hotz, which he calls First Year Algebra Scales. Illustrative problems from the series are the following:

Addition and Subtraction

Carefully perform the operations as indicated.

$$7x - x + 6 - 4 =$$

$$\frac{3 - 2x}{(x-1)^3} + \frac{x+1}{(x-1)^2} - \frac{1}{(x-1)} =$$

Multiplication and Division

Carefully perform the operations as indicated. Reduce all answers to their *simplest* forms.

$$a^3 \cdot (-3a) \cdot (-2a) =$$

$$\frac{x^3 + 27}{x^2 + x - 12} \div \frac{3x + 9}{x + 4} =$$

Equation and Formula

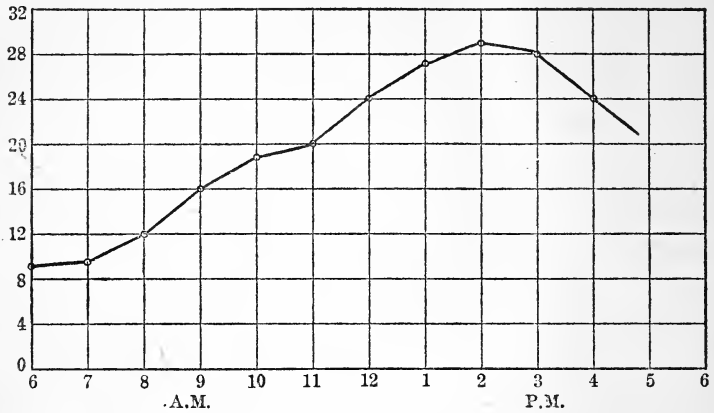
Solve the following equations and formulas.

$$10 - 11z = 4 - 8z$$

$$\frac{6x - 2}{x + 3} - 3 = \frac{3x^2 + 13}{x^2 - 9}$$

Graphs

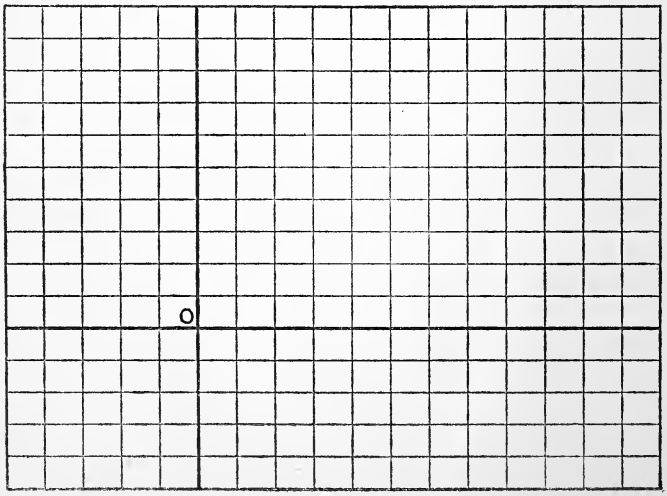
The following graph represents the temperature at various hours of a certain day:



How many degrees was it at twelve o'clock?

Find three pairs of values for x and y in the following equation and then draw the graph of

$$x + y = 5$$



Problems

Do not work out the answer to the problem—merely *indicate* the answer or *state* the equation in each case.

A man is m years old; how old was he r years ago?

A train leaves a station and travels at the rate of 40 miles an hour. Two hours later a second train leaves the same station and travels in the same direction at the rate of 55 miles an hour. Where will the second train pass the first?

A fourth series of tests in first year algebra is that proposed by Rugg and Clark. The following are illustrative examples of the series:

Test No. 1. Collecting terms. $7x + 5y - 4x - 3y$

Test No. 2. Substitution. If $x = 2$ and $y = 3$, what does $2x^2 + 3xy = ?$

Test No. 3. Subtraction. From $2a + 3b - 4$ take $5a - 2b + 1$

Test No. 4. Simple equations. $2x = 12 + 4x$

Test No. 5. Parentheses. $3(4x - 7)$

Test No. 6. Special products. $(3a - 4)^2$

Test No. 7. Exponents. $a^2 \cdot a^3$

Test No. 8. Factoring. $x^2 - 5x + 6$

Test No. 9. Clearing fractions.

$$\frac{x+3}{4} - \frac{x-2}{5} = 0$$

Test No. 10. Fractional equations.

$$\frac{2x+3}{5} - \frac{x-2}{3} = 1$$

Test No. 11. Practical formuls. If $a = b/c$ what does $c = ?$

Test No. 12. Quadratic equations. $x^2 - 9x + 20 = 0$

Test No. 13. Simultaneous equations. $2x + 3y = 5$, $4x - 3y = 1$

Test No. 14. Radicals. $\sqrt{a^2b^3}$

Supplementary Tests.

Test No. 15. Graphs.

Test No. 16. Quadratic equations (irrational roots). $2x^2 + 5x - 1 = 0$

Somewhat more extended than these is the series of Rogers Tests. These include (1) a "Computation Test,"

with simple problems involving the principal operations up to simple fractional equations and simultaneous equations of the first degree; (2) an "Interpolation Test," wherein the student is to insert the appropriate terms in series such as 2 4 — 8 10 — 14; (3) a test for "Matching Nth Terms and Series," wherein the student is to select from a given list of formulas the appropriate one for each series in the test, such as the formula $4n - 1$ for the given series 3 7 11 15 19 23 27; and (4) a "Reasoning Test," with problems like the following:

M is younger than N
K is older than N
M is older than L
} therefore K is.....L

M is younger than N
K is older than N
M is older than L
} therefore N is.....L

A test in physics has been devised by Professor Starch. His directions for the use of the test are the following:

"The test may be given at the end of the year or the various sections may be given after the completion of the different topics.

"Allow the pupils as much time as they reasonably need to complete as many of the statements or problems as they can.

"Score the tests by determining the number of statements completed or solved correctly. The number, not the percentage, of the statements finished correctly is the score."

The following are illustrative problems or statements from the five sections of the test:

Mechanics

The *erg* is the work done by a force of ..... acting through a distance of .....

The specific gravity of a wooden ball that floats two-thirds under water is .....

Heat

The number of work units that correspond to a heat unit is called .....

Sound

The frequency of vibration of a string varies inversely as .....

Light

A continuous spectrum composed of the colors from ..... to ..... is produced by passing ..... light through a prism.

Magnetism and Electricity

The instrument for the comparison of currents by means of ..... is called a galvanometer.

If a storage cell has an E.M.F. of two volts and furnishes a current of five amperes, its rate of expenditure of energy is ..... watts.

The distribution of problems is as follows. Mechanics 28, heat 8, sound 9, light 9, magnetism and electricity 21.

Professor Starch has also given us a set of tests for the subjects of Latin, German, and French, dealing with vocabulary and reading in each. The form of test is the same for the three languages. The general instructions read as follows: "Do these tests according to the directions given and hand them in at the next time. Do not consult any dictionary, vocabulary, or person."

The vocabulary test is a double one, each part consisting of one hundred words of the foreign language alphabetically arranged, and on the same page is an alphabetical list of the one hundred English equivalents, numbered in order as they stand. The pupil is directed to place after each foreign language word the number of its English equivalent.

In the reading test the instructions are these: "Translate the following sentences. Write the translation under each sentence." Then follow thirty sentences, the first of which are very simple one-word sentences, and the remainder of increasing difficulty and length. For the three languages, the thirtieth sentences, presumably representing the greatest degree of difficulty, are the following: "Rex erat Æneas nobis quo iustior alter, nec pietate fuit, nec bello major et armis." "Also gingen die zwei entgegen der sinkenden Sonne, die in Volken sich tief, gewitterdrohend verhuellte." "Du reste, il était demeure aussi simple que le premier jour."

"The vocabulary test is scored by ascertaining the number of words designated correctly in each list. . . . The reading test is scored by determining the number of sentences translated entirely and correctly."

A German-vocabulary test and a Latin-vocabulary test somewhat similar to those just described have been devised by Professor F. L. Clapp. The German-vocabulary test consists of three hundred German words, the Latin-vocabulary test of two hundred Latin words. The essential feature here is that the pupil does not select an appropriate meaning from a given list, but must write the English equivalent after each foreign language word, quite unassisted by any suggestion which the list of such equivalents might offer. Moreover, the words which constitute the list are not merely typical words chosen at random, but are those which occur most frequently in the texts usually read in secondary schools.

Two other tests which Professor Clapp has devised are his German-construction test and his Latin-construction test. The instructions, which are nearly identical for the two tests, are as follows:

I. For application.
   1. Allow ..... minutes for the test.
   2. Emphasize the fact that the test is a construction test and the form of the word is the important consideration.
   3. Explain that a few words are omitted from the vocabulary because, if given, they would suggest the proper construction.
   4. Take the time of each student and have it recorded in the proper space.

II. For scoring.
   1. The value of each sentence and of each word is indicated below.
   2. (German test.) Subtract two points for a wrong word order.
      (Latin test.) Give full value for constructions other than those below, if correct.
   3. (Recording of score.)
   4. To obtain the final score add the scores for the different sentences.

Illustrative sentences are the following:

1 4 3
Agricola puerum laudat. (8)
4 3 3
Domicilia movere cupiunt. (10)
2 1 1 1 2 1
Darf ich drei gute Bleistifte haben? (8)
1 2 1 2 2 1 1
Die Städte sind grösser als sie waren. (10)

The tests for which the above sentences are the solution are these:

Latin test:
The farmer is praising the boy.
(agricola) (laudo) (puer)
They want to move the houses.
(cupio) (moveo) (domicilium)
German test:
May I have three good pencils?
The cities are larger than they were.

An accompanying vocabulary includes the following meanings:

have—haben	city—die Stadt
three—drei	be—sein
good—gut	large—grosz
pencil—der Bleistift	than—als

Our enumeration of tests for secondary school studies must close with the mention of four which are still too recent to be more than tentative in character. Under the title of "A Preliminary Study of the Measurement of Abilities in Geometry," [1] Stockard and Bell describe a test designed "to call for information that is to be found in all standard textbooks; to test for important and fundamental principles of geometry; to provide such a range of questions as to be representative of the whole field of elementary geometry, and in-

[1] *Journal of Educational Psychology*, December, 1916.

clude memory facts, knowledge of content, organization of subject matter, and power to do 'originals'; and to confine the list to such dimensions that every question could be tried by the average high school pupil in a period of forty minutes." The Rogers Tests, referred to on page 281, include also a Geometry Test, wherein a number of geometrical propositions are to be proved, the proofs being based upon certain geometrical facts supplied in the test, and no other facts being assumed or employed.

Still more recent is a scale in ancient history, suggested by Leroy W. Sackett,[1] and described as a test of "ability to recall definite facts promptly" in the field of study indicated.

Finally, mention should be made of a test which, though applying to no specific secondary school subjects, is intended for high school students. This is the Kansas Silent Reading Test Number III, devised by F. J. Kelly, and is one of a series of three covering the whole range of public school work above the two primary grades. The test consists of sixteen brief paragraphs, each closing with a question the answer to which involves an understanding of the thought of the paragraph. The aim of the test is to measure the ability of the pupil to comprehend what he reads.

The above will give the reader some idea of the meaning of standardization of attainments in school instruction, its forms, and the methods of its application. It must be remembered that standards or scales have been attempted in subjects other than those mentioned, and that details of derivation and application have been omitted in our treatment. Despite the small amount of work yet accomplished in standardization, especially in secondary education, an understanding of its general principles, its method and value, may be of much practical service to the progressive teacher on the lookout for anything whereby his efficiency may be increased and his work made more significant.

[1] "A Scale in Ancient History," by Leroy W. Sackett, in *Journal of Educational Psychology*, May, 1917.

The Grading of Pupils' Work.—The present section has hitherto dealt with educational measurements wherein a zero grade was accessible as a basis for measurement of ability. We observed, however, that in the case of the surveyor who did not know the sea level, a comparative evaluation is usually possible even though no zero grade or absolute standard is available. Even though we may not say how many units of ability an individual possesses, we can determine his relative efficiency as compared with others of his class. While we thus lose the benefit of an absolute standard, we have in the performances of many individuals a relative standard which may serve our purpose.

Investigation, as well as common experience, has shown that the distribution of abilities among the members of a group has really a considerable degree of constancy. Only a few members of the typical class are brilliant, only a few stupid. The proportion of brilliant, stupid, and mediocre seems to be fairly stable, and, in fact, is capable of approximation in mathematical terms. The principle may be illustrated as follows: We find in our school one hundred boys about twelve years of age. All of the hundred are lined up for a foot race across a field, and started simultaneously. While all are still running, we give a signal for each to halt where he is. We might then find some such result as this:

1	boy	had run	about	200	yards.	
2	boys	"	"	"	190	"
8	"	"	"	"	180	"
16	"	"	"	"	170	"
25	"	"	"	"	160	"
23	"	"	"	"	150	"
14	"	"	"	"	140	"
9	"	"	"	"	130	"
1	boy	"	"	"	120	"
1	"	"	"	"	110	"

For convenience we graph the results, letting the height of each column or rectangle represent the number of boys who have run the indicated number of yards.

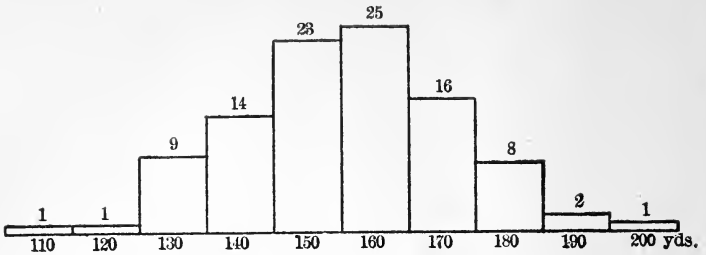


FIGURE 1.—Graph of normal class

The fact that the great majority of the boys come near the middle of the scale of ability merely accords with a scientific principle. Scientific study has shown that in a normal representative group, if there is no influence to affect the composition of the group, the distribution of abilities in other fields besides speed tends toward a constant relationship. We are told that in a normal class in school this distribution of intellectual ability necessarily holds the same as elsewhere. Various formulations of such a class have been proposed, though the scientific principle involved is a highly complex one, and its applications have not yet been fully worked out. The following is a typical formulation for the distribution in a normal class:

4% are of high ability.
21% are of good ability.
50% are of fair ability.
21% are of poor ability.
4% are of very poor ability.

While some variability exists in the number of divisions and in the corresponding size of each, we are told that the classification must be such that approximately half of the class belong to a group of mediocre ability, with one-fourth of the class rated higher, one-fourth lower than this mediocre group.

An attempt has been made to apply this principle to the grading of students in school and college classes. Assuming

that the classes are normal and that each student's work is representative of his ability, we are told that at the end of a course[1] we should grade the best four per cent of the class in the highest group, the next twenty-one per cent in the next group, the next fifty per cent in the middle group, the next twenty-one per cent in the next lower group, and the lowest four per cent in the lowest group. Possibly these groups might be thought of as "excellent," "good," "fair," "poor," and "very poor" respectively, provided the name thus assigned does not affect the judgment of the teacher in the distribution of the grades. Or, using letters to represent the five groups of merit, we would give four per cent of our class a grade of "A," twenty-one per cent "B," fifty per cent "C," twenty-one per cent "D," and four per cent "E." Had we chosen to vary the number of levels into which to divide the class, our percentage would naturally be different, although the same principle would govern.

The superiority of this system of grading the work of students over an assumed absolute basis, such as the percentage rating, is in several respects both theoretical and practical. In the first place, the use of a percentage system implies an absolute standard of evaluation, with both a zero and a perfection grade known. As a matter of fact, neither of the latter is available. One hundred per cent cannot represent perfect attainment either for class work or for examination. That a student's performance of every task and every possibility of learning has been complete every moment of the term or year is absurd and, indeed, nobody knows what such perfection would be. As an examination grade, perfection is not possible unless the test be so exhaustive and difficult that more could not have been accomplished. The student who requires the entire period to produce a "perfect" paper has not done as creditable a piece of work as the one who finished an equally good paper long before the closing bell rang. On the other hand, the zero quality of work is inconceivable

[1] This refers only to final grades, and not to daily class grades.

for any *bon-fiade* member of the class. Thus, the impossibility of an absolute standard or scale precludes percentage grading as a reliable index of student attainment.

The practical objections to ranking students on a percentage basis are well known. The absurdity of saying that one student has done one ninety-fourth better, or two eighty-seconds poorer, work than his fellow has appealed to every conscientious teacher, who has often sympathized with the pupil's revolt at the injustice resulting from the attempt at such discrimination. A serious weakness in the instruction also may be attributed to the attempt at absolute evaluation of students' work in the classroom or examination. This is the unsystematic and widely varying grading of students on the part of teachers whose ideas of relative values are different. Some teachers, more kind than conscientious, are liberal with high grades. Others, thinking to maintain high scholastic standards, give many low grades. Still others, feeling uncertain of the quality of work done, give nearly all students medium grades, with the thought that such grades cannot be far wrong in any case. The distribution of grades on the system proposed, often referred to as "scientific grading," is designed to meet the objections raised against any attempt at absolute grading by either letters or percentages. A considerable number of educational institutions, especially colleges and universities, have adopted the system, and report highly beneficial results.

However, this scientific distribution of grades has its limitations as well as its merits, and is not universally accepted as the solution of the grading problem. Let us revert to the illustration of the schoolboys in the foot race. It is evident that if before the start all the boys who had ever won a foot race before were debarred, the distribution of results would have been different. Presumably the graph on page 288 would have been greatly altered at the right. The elimination might have removed the three best runners, and most or all of the 180-yard class, though without much effect

upon the rest of the group. Or suppose that part of the younger boys had just been playing vigorously and were fatigued. Then the left part of the graph would have been extended to the left, since the performance of that group would be greatly reduced. The result in either case, or other cases easily imagined, would no longer follow the normal distribution, due to the influence of an outside disturbing factor. Our specification that the group be typical would not be met. In the distribution of class grades the same principle would apply. The division of a class into sections on the basis of age or proficiency, or a deficiency of preliminary training on the part of a considerable number of pupils, would greatly alter the distribution of abilities, giving us graphs similar to the following:

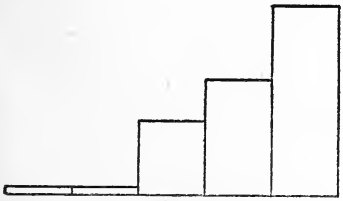


FIGURE 2.—Class divided in two sections: Section II, with younger or less able students

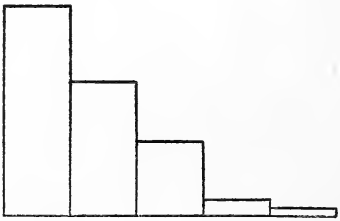


FIGURE 3.—Class divided in two sections: Section I, with older or abler students

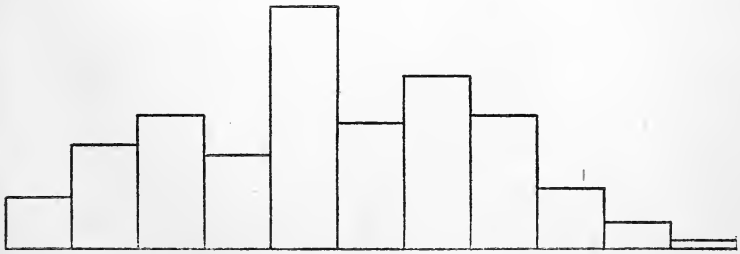


FIGURE 4.—Class with a considerable number of students deficient in preliminary training

Or we might have a class so small that all of the various grades cannot be adequately represented, as, for example, with a class of ten pupils. It is evident that the distribution can be strictly applied only when the class is normal and of considerable size. The principle of distribution of grades is thoroughly sound, but must be applied rationally and discriminatingly.

Anything more than this rapid survey of some of the standardization already attempted would be inappropriate for this text. Full expositions would require more space, and are readily available elsewhere. Moreover, the problem of standardization is receiving much attention in the educational world, and it is reasonable to expect that before this account reaches the hand of the reader much of the work already done will have been reconstructed and helpful standards formulated in fields not yet provided for.

4. The Practical Value of Standardization and Measurement in Secondary Instruction

The Teacher's Use of Measurement.—Do standards in education represent degrees of excellence to which the pupil is expected to attain? Or are they degrees of excellence by means of which students' work can be evaluated? The discussion in the preceding section implies a negative answer to the former question, to the latter an affirmative, but with reservations. The only standard which could be used for all to seek to attain would necessarily be perfection, but perfection is, from the nature of the case, unattainable. On the other hand, an absolute standard must represent a series of grades of excellence such that any piece of work may be evaluated by finding it equal to some known value in the established scale.

We saw, further, that standards are essential for the accurate and scientific measurement of educational products. In the absence of such standards, however, the teacher need

not lose all of the value to be derived from educational measurement. Progressive teaching is that which is permeated by a consciousness of its aims and a constant search for the best means for their realization. The teacher must, therefore, be an experimenter, employing all means for the improvement of his instruction, even though these means fall short of perfection, and devising applications and extensions of even the inadequate means in his quest for greater efficiency. The standards and measurements we have treated in this chapter are not perfected but, on the contrary, are only partially successful. However, in the hands of the progressive instructor, some of them at least may be made to render valuable service in the improvement of teaching and the extension of high ideals of scholarship. Some suggestions on the practical application of a few of the standards and measurements we have studied may prove of profit to the high school teacher.

Of the absolute standards, that for handwriting is of value to the secondary school teacher chiefly as suggestive of method of procedure. The Courtis Standard Tests are intended primarily for elementary education, although they may well be employed in the arithmetical work of the junior high school. The Hillegas Test aspires to serve in secondary as well as elementary education, but the criticism we have noted is even more applicable to its use in high school work than in the lower grades. The more advanced the work the more complex, and hence the more variant, will be the judging of compositions of students. The Harvard-Newton Scale appears more workable as a standard, especially for the eighth grade work, and may with profit be extended and employed in the other grades of the high school. However, as a means of comparing the work of any class with the typical work of many other similar classes, the data as yet secured are scarcely adequate for anything like standardization. The tests for algebra, geometry, physics, foreign languages, and history are, of course, designed specifically for secondary education. Undoubtedly the tests in the field of algebra have been de-

veloped much beyond those of the other fields, and are based more clearly upon established norms of what the study should produce. Here, more than in the other studies, the element of skill is involved, and less of thought power and information—a circumstance which renders algebra far more amenable to measurement. The tests in secondary education, the best known of which have been briefly described in the preceding section, are as yet too new to have been thoroughly tried out, but an intelligent use of them, with due recognition of their limitation, can scarcely fail to give the teacher a better knowledge of what his pupils are doing and what they need, both individually and collectively.

In the absence of fully established standards for evaluation, the progressive teacher need not idly wait for the deficiency to be supplied. Not as accurate scientific investigation, to be sure, but for a better understanding of his own work, any trained high school teacher ought to be able to devise for himself tests whereby the profit derivable from the standardization is in some degree attainable for him. In the formulation of such a test, clearly the first thing to do is to determine just which of the five aims of instruction figure the most prominently in his subject. If his field be geometry, for example, he may decide to test for the thought power of his pupils. Since he must, so far as possible, isolate the factor for which he is testing, he will endeavor to formulate such a test that the other factors (knowledge, appreciation, efficiency in expression and application, and permanency) are as nearly as possible eliminated. This does not mean that the test will involve none of these four factors, but rather that in so far as they are involved their mastery sufficient for the test is assured at the outset, so that no failure in one of them can prevent the free exercise of the thought power which is to be tested. Thus, any definitions, modes of mathematical expression, and the like, must first be made sure of as being in the student's possession. Then the test can be so formulated that only thought power functions in the result.

Similar methods may be employed in other fields of study, and in testing for other educational products. Tests for memory are, doubtless, easy to devise. The measuring of efficiency in expression or in application, and of the permanency of acquired experience is also possible. The testing for appreciation has always been a puzzling problem for the teacher, and the writer is indisposed to tell how it can be done. At best, the testing must be indirect, and applied to the somewhat remote and unreliable products. Since it is evident that what is not felt cannot be expressed, the expression by the pupil of what he has felt is doubtless the most available index of the feeling. Here, as in the illustration from geometry, in the preceding paragraph, care must be taken that defective power of expression is not mistaken for lack of content for expression. The teacher should therefore endeavor to determine the pupil's ability to express himself before the test for appreciation is undertaken. Another form of test, from which expression is eliminated, is that of calling for a comparative evaluation of specimens of æsthetic material. Here, however, the fact that different kinds of material have not the same appeal for different individuals renders inadequate any test save a very extended one with widely different types of content.

However, the formulation of a test for a given factor does not consist alone in the elimination of all other factors. The test must actually hit the thing sought for. Obviously, it must be adapted to the experience and training of the student. This will necessitate careful study and planning, extended observation, and some experimentation. The teacher whose colleagues, especially in the same field of study, are interested in problems of experiment and investigation, can naturally profit greatly from conference and criticism. The problem is so complex and many-sided that the joint product of many minds is presumably better than that of one.

The real value of these educational measurements lies in their application to the work of teaching. The forms of ap-

plication we enumerated early in the chapter. These are (1) the determination of the students' present educational status, as a basis of comparison with their status at an earlier period, or with the work of other groups; (2) the experimental investigation of the relative merits of different methods of instruction, and (3) the discovery of the special capacities and needs of individuals. Some suggestion on the method of utilizing the tests for each of these purposes may be of service.

Determination of Class Achievement.—In the first of the three applications mentioned, where the aim is comparison, the prime essential is uniformity of both content and conditions. It should be noted that in the standard tests there is no difference in content for the various ages of the pupils. The fourth grader and the eighth grader are set exactly the same problems, and the grading is based only upon the degree of excellence of the performance. For the measuring of the progress made by a class during a semester of study, therefore, it is essential that the tests given at the beginning and end of the semester represent exactly the same content and difficulty, and, if possible, the questions should be the same in both cases. Identity of questions, however, may not in some cases represent identity in test, since the practice or memory from the first may render the second easier. To meet this difficulty, the Courtis Tests include more than one set of questions, representing the same thought processes, but with somewhat different details of content, so that a student would naturally earn the same score whichever of the alternative test questions are used.

When a comparison is to be made between different classes or schools, naturally the tests should be made identical, although in their formulation care should be taken that the questions mean the same for all the groups examined. In the high school even more than the grades teachers differ in the use of terms, so that a question clear enough to one class may be puzzling to a similar class under another instructor.

The conditions for conducting the tests should also be

the same. Such elements as fatigue, strangeness of environment, distraction of attention, or misconception of the significance of the test will necessarily affect the students' performance. The necessary explanations to the class of the method of procedure and meaning of the questions are also liable to be differently given by different examiners. To secure uniformity in these points it is essential that the conditions of the different tests receive careful attention and, if convenient, the tests should be conducted by a single examiner. It need scarcely be added that the system of scoring results must be uniform and clearly understood.

Experimental Evaluation of Methods of Instruction.— The second form of application of measurement is for the comparing of different methods of instruction in order to determine their relative merit. Here, too, as in all comparison, uniformity of conditions is essential. Pedagogically as well as psychologically comparison involves the identity of all the factors in the things compared, save the one factor which is being investigated. In the comparative study of methods the teacher is the experimenter, and must observe the requirements of experimental procedure. A study made a few years ago in the University of Illinois will serve as an illustration.[1] It was desired to determine whether zoölogy, when taught with constant reference to its economic applications, would not lead to better mastery of the subject than when taught with the usual academic interest as the basis of appeal. In order to secure identity of conditions the class was divided into two sections, on a basis in which scholastic ability and interest were not involved. The two classes were equal, in so far as could be determined, and were given the same instructor, the same time, and the same conditions of work. Only the method of instruction was different, in that the economic applications were stressed in the one case, and not in the other. At the end of the course the examination

[1] Already referred to on p. 147. For a description of the experiment, see article in the *Journal of Educational Psychology*, vol. I, p. 321.

questions prepared for the non-economic section were made the basis for testing the economic sections as well, since it was desired to find out whether the economic treatment would not produce a better knowledge of the material which formed the basis of the non-economic treatment.

In experimentation of this kind it may not always be possible or necessary to divide classes into sections for comparison. When it is desired to employ the test for a specific unit of subject matter, the teacher may conduct the test as a comparison of classes taught in successive years. Here, however, he must be careful to secure as great similarity of conditions as possible, including the interests and ability of the classes themselves, and for reliability of conclusions the teacher should not depend too much upon his memory, but should keep a faithful and detailed record of procedure and results. This process of comparison may involve the testing of classes for several years before final conclusions can be drawn. The delay is not fatal, however, and the chances are that in the course of the testing the teacher will have learned from his experimentation many unanticipated lessons of value even equal to that of the test itself, due to the closer attention and care given to the instruction.

In the testing of methods the personal factor is likely to play an important part. Uniformity of procedure in a test of pupils' ability is far more easy to secure than in a test of methods of instruction, for in the latter the procedure is less exact and not only permits but demands a great degree of adaptation to the pupils' response. The element of enthusiasm is also important. It is not easy for a teacher to employ two different methods with the same degree of confidence and zeal. The one he has always employed may inspire an attitude of confidence; the new one may appeal because of its freshness and promise. Really, the comparison must be made between the two methods with each at its best, and the teacher must inject his best self into each. It is because of this personal element in teaching that comparisons of method

are often valid for the experimenter only, although of suggestive value to others. The inference naturally follows that the progressive teacher will be both an observer of others' experiments and an experimenter for himself.

Discovery of Individual Needs.—As a means for the discovery of students' individual capacities and needs, the special test must begin where the regular instruction leaves off. The daily work of the classroom is the first and, possibly, the best instrument for the observation of individual variations. Each recitation, each written exercise, each class test and examination should serve somewhat to disclose to the teacher what each pupil is doing, can do, and should do. The function of the special test such as we have been considering is to complete the observation of the regular instruction. When the class work gives inadequate returns, the teacher's next problem is a diagnosis of the difficulty, and for this purpose special tests may be devised and employed. Also, the giving of standard tests to whole groups or classes should show in a more specific way the needs of individual students. Unfortunately recitation, examination, and test are too often used solely for the discovery of *how much* the student can do, rather than *what* he can do.

The test for the discovery of individual students' needs is thus usually the group test, with individual variations noted in the interpretation of results. Even when individually administered, the test is not essentially different in character from that for a group. There is needed, therefore, no further consideration of form or method than that already given for group tests.

Ultimate Function of Testing.—The measurement of student ability serves a higher purpose than merely the securing of information. In each of the aims we have been discussing the information secured was for the sake of improvement of instruction. The measurement of students' progress should show the teacher whether his class is really making the advancement which might reasonably be expected. Time and

effort expended are really far from indicative of work accomplished. The fact that a class have worked faithfully for a year on ancient history is no proof that they have done a year's work, and many a teacher would be greatly disappointed were he to know how little had really been accomplished in his class. The test, whatever its form, should serve to show just wherein his work is succeeding, wherein it needs reconstruction, and possibly will suggest the character of such reconstruction or of some experimental investigation for the discovery of better method. Kinds of error, therefore, and not scores alone should be scrutinized in testing.

As a basis for the comparison of work between groups or schools, the standard test, and even the improvised test, should assist the teacher in determining whether his class is making the progress that might reasonably be expected. In some of the elementary subjects what might be called minimal standards have been formulated, by averaging the scores of large numbers of children in various schools through such tests as the Courtis Tests, by a consensus of opinion on the part of educators and educated, by a study of the demands upon knowledge made by the experience of adult life, and in other ways.[1] In so far as these deal with subjects taught in the high school, they may with great profit be made the basis of comparison by the teacher for the checking up of his own work and the discovery of shortcomings. Where such standards have not yet been determined, and this includes practically all of high school work, improvised tests such as have been mentioned before may be of service in the formulation of provisional or working standards. While the inferences resulting from the employment of such tests may not be conclusive, the teacher can make them stimulating and suggestive in his quest for weaknesses in his method. The teacher whose classes make a poor showing can at least investigate the methods of the teacher whose showing is better. Com-

[1] *Cf.* "Fourteenth and Sixteenth Year Books of the National Society for the Study of Education."

parison of results leading to comparison of methods is essential to professional advancement, and might with profit displace much of the content of the typical teachers' institute and association meeting.

We have said that the results of these tests, even of those most generally accredited, are not necessarily conclusive. The teacher must not let his success in meeting the standard blind him to the fact that the standards are as yet not fully established, nor do they cover all of the educational aims. He should take them for what they are, and participate in the work of their improvement. He should realize that for some of the most important educational aims no test has yet been devised, and that success in the measurable features may have resulted from formal drill at the cost of thought and feeling. He must, in other words, be a student of educational aims, and a critic of educational tests in the light of these aims.

The employment of the results of measurement in dealing with individual variations and needs requires no further consideration. The discussion of individual instruction in Chapter XV will, we trust, suggest to the reader how the work of instruction may take account of individual variations and needs.

The Grading of Pupils.—In the preceding section attention was called to the inadequacy of any attempt at absolute grading of students' attainments for a year or term. In place of the percentage basis of ranking, recourse was had to the rating of students by their relative attainments in the group, and a system of grading was proposed based upon the normal distribution of abilities in a typical class. Objection was made, however, that not all classes are typical, and that various influences may work to interfere with the proposed distribution of grades. With the percentage system of grading discredited, and the grade distribution found to be limited in its use, the teacher justly asks for positive suggestions.

With the large class, the system of grade distribution is applicable, and is proving its merit. Whether the division be one of five groups or ranks, as in the illustration, or of more or less, is not vital so long as the relative size of the groups is in harmony with the law of the normal distribution of abilities. That more than six groups would needlessly increase the nicety of discrimination is evident. On the other hand, less than four groups would throw into one class individuals of such wide difference of merit as to largely nullify the aim of the grading. Practical experience points to the five-level grouping as the most satisfactory.

With the small class the problem is less simple. Not merely does the smallness of the class preclude a group division in the proportion advocated, but its smallness raises the presumption that some special influence is affecting the size of the class, and hence rendering it non-typical. In such case the teacher has recourse to two methods of grading which will tend toward reasonably accurate results, especially if used jointly. In the first place, he may regard all his pupils of several successive classes in the subject as constituting one large class, and then test the grades assigned in them to see if their distribution has corresponded to that accepted as the standard.

The second procedure is more complicated, but yields more immediate results, and in the case of small classes has been found quite practicable. Here the teacher associates with each grade or letter the quality of work which he thinks it should represent, and assigns the grades to the students accordingly. In so doing, however, he must take account of the normal size of each group; that the division is into not equal but very unequal groups, with the middle group very much the largest. His next step is to check up his standard of evaluation, and for the purpose uses the grades assigned the same students by instructors in other subjects. If comparison shows, on the whole, a close similarity between his own grades and the average of those given the same student by

other instructors, the comparison being made for each student rather than for the average of all students, it is reasonable to infer that his grading is, on the whole, neither too lenient nor too severe. He should further observe the distribution of his grades. Let us suppose that a student receives the following grades: Latin, B; history, A; mathematics, B; English, C. Since his average is B, we might call his history grade a relatively high grade, and his English grade a low one. It is evident that a teacher who in the long run shows a marked tendency to give many such relatively high or low grades has an inadequate conception of what should be expected of students. The relation may possibly be better understood if expressed thus: Too many low grades implies too high a standard for "poor"; the teacher is calling work poor which is of fair quality. Too few low grades implies too low a standard for "poor"; the teacher is calling work fair which is of poor quality. Too many high grades implies too low a standard for "good"; the teacher is calling work good which is of fair quality. Too few high grades implies too high a standard for "good"; the teacher is calling work fair which is of good quality. A combination of too few low grades and too few high grades implies a disposition to use the medium grade as a catch-all for cases of whose evaluation he is in doubt. A combination of too many low grades and too many high grades implies a tendency toward extreme judgments, regarding as very good what appeals to him favorably, and as very poor whatever is not well up to the average.

The fundamental principle in the above is, of course, the superiority of the judgment of many teachers over that of one. The objection will doubtless be raised that students vary greatly in the quality of work done in different subjects, doing better in subjects which interest them, or in which the instructor is more insistent on creditable work. That such tendency exists is unquestionable; that there is really less of it in a well-administered school than is often imagined can

be seen by a study of students' grades.[1] The reply to the objection is that there are as many upward as downward variations of this sort, thus tending to offset each other, and especially that only well-defined and obvious tendencies are considered. The seeming complexity of the system is largely removed by an understanding of the principle which determines the inference.

An annual or semi-annual comparison of grades by the system just described, especially when checked up by a grade distribution jointly for several successive classes, will furnish the instructor with a reasonably accurate analysis of the character and degree of his errors in the grading of students' work. At its best the system is subject to several errors of method; but at its worst it gives much needed and serviceable results, and is probably the best that has been devised for small classes.

It not infrequently happens that a teacher, in distributing his grades according to the principle we have discussed, cannot avoid the conviction that a real injustice is being done thereby. In other words, he feels that for the class in question the graph of the grades should not follow the normal form, but should indicate a variation similar to that of the non-typical groups of our foot-race illustration.[2] Such a conviction should be followed up by a discovery of the influences which cause the variation (known to statisticians as the "skew" in the graph). Possibly a lack of adequate training before entering the class, an attitude of indifference, or a lack of clarity in the instruction may have caused a considerable number of the students to do work inferior to that which their natural ability would ordinarily produce. Such influences would result in an excessive proportion of poor students, giving the graph a skew to the left, as in Figure 5.

[1] *Cf.* doctorate dissertation by D. E. Weglein on "The Correlation Between the High School Student's Grades" (1916). Also, "Correlation Among Abilities in School Studies," by D. Starch, in *Journal of Educational Psychology*, vol. IV, p. 415.

[2] *Cf.* p. 290.

FIGURE 5.—Graph of class with many poor students

If the condition is extreme, it may even cause a cleavage of the class into widely divergent groups, with a graph as in Figure 6.

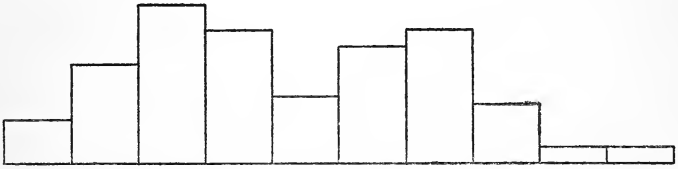


FIGURE 6.—Graph of a class with a considerable number of very poor students, the rest being of normal ability

On the other hand, a preponderance of high grades, giving the graph a skew to the right, might indicate that in some way the class represented a select membership, due to the weaker pupils having in some way been eliminated before entering the class. It might also be traced to unusually skilful instruction, whereby students are inspired to exceptional zeal. Unfortunately, the explanation most often to be found is a leniency in grading.

Thus the use of relative evaluation of student achievements, grading them according to their rank in the class, may prove helpful by pointing out the presence of abnormal or undesirable influences upon the work of the class. It seems superfluous to add that it is the business of the teacher to study and interpret his grades, to trace out the influences which are affecting the work of the class, and to strive to improve his instruction by the elimination of the negative, the cultivation of the positive, influences.

5. Summary

Teaching efficiency demands that the present self-confident non-critical procedure shall give place to a thorough testing of instruction by a measurement of its products. A system of standardization and measurement would facilitate the measuring of students' progress, the comparison of the work of different classes or schools, the experimental investigation of the relative merits of different methods of teaching, and the discovery of individual needs and differences.

The essentials of an educational standard are five: objectivity, definiteness, absoluteness, inclusiveness, and practicability. Only that can be accurately measured which admits of an applicable standard, and in which the characteristic to be studied is actually knowable, and its zero degree can be determined. The degree to which measurement can be applied to knowledge, thought power, appreciation, efficiency, and permanency varies greatly in the different cases, due in part to the impossibility of their isolation for study.

There are in practice two types of measurement: that with exact measurement based upon an absolute standard, and that with relative evaluations, based upon the comparative ranking of the individual in a group. Of the first type are such as the Thorndike Scale in handwriting, the Hillegas Scale in English composition, and the Courtis Tests. The second type includes the distribution of grades according to the law of distribution of abilities. The latter plan insures a more just and objective basis for evaluation, but is strictly valid only with normal groups.

The standard tests already devised should prove of value to the secondary school teacher as suggestive of methods of investigation of his own. Testing for any of the products of instruction, he must endeavor to isolate the factor investigated. In comparative measurements the form and conditions of the test must be clear and uniform. The results of the measurements should show the character and needs of

the instruction being offered, and should suggest the form of its improvement. In the case of the distribution of students' grades where the classes are small, comparison should be made with the grades of other instructors to disclose tendencies toward misjudgment of values, and the grades of several consecutive years should correspond to the general principle of grade distribution. Tendencies of classes to deviate from the normal distribution of abilities should lead the teacher to the discovery and correction of any unfortunate influences causing such deviation.

QUESTIONS FOR DISCUSSION

1. Some teachers object strongly to the application of the principle of standardization in teaching. Suggest reasons (sound and unsound) for such objection.

2. Discuss the advisability and methods of having pupils keep records and graphs of their own achievements.

3. Find out what you can of each of the tests suggested, and discuss the degree to which they meet the five requirements of a good measurement scale.

4. Of the five instruction aims, which are measured by each of the tests described? In each of the tests, what instruction aims are ignored or slighted which you consider fundamental in the subject in question?

5. In each of the following studies, for what educational products would you undertake to measure, were you to devise tests for those studies: civics? Latin or Spanish prose composition? manual training? English literature? botany? Selecting one of these studies, tell how you would go about the formulation of a test for it. If you think any of them incapable of measurement, justify your position.

6. A class of about thirty pupils had a normal distribution in its membership. To it there were added about twelve pupils, who were the best members from another class of about thirty-six pupils in the same work, and also of normal distribution. Plot a graph which might represent the distribution in the resultant class.

7. The following grades were given in a certain (hypothetical) high school. For convenience of study it is assumed that there are eight instructors and twenty pupils, and that each pupil carries five studies. Criticise the grades of each instructor, from each of the

points of view treated in the text. A, B, C, and D are "passing grades."

	PUPIL									
INSTRUCTOR	1	2	3	4	5	6	7	8	9	10
English	B	C	B	B	C	C	D	C	F	A
Mathematics	C		C	C	A		B	B	C	C
Latin	A	B		B		C		C	D	
Spanish		C	A		A	B	C		B	A
History	F		C	A	B			D		
Physical Science	C	D		C			B			B
Biological Science			C			C		B		
Agriculture		A			B	B	A	B		A

INSTRUCTOR	11	12	13	14	15	16	17	18	19	20
English	B	C	C	B	F	D	D	C	D	D
Mathematics	B	A	F	C		C	C	B	B	B
Latin	B	F		C	D	A		C		
Spanish			C		B	C	B		B	C
History	D		C		A		C		F	
Physical Science		C		D	B			B		
Biological Science	C		B			C		B	B	D
Agriculture		A		B			B			B

SUPPLEMENTARY READINGS

Birch, "Standard Tests and Scales of Measurement," in *Psychological Clinic*, April 15, 1916.

Parker, "Methods of Teaching in High Schools," chap. XXII.

Dearborn, "The Misuse of Standard Tests in Education," in *School and Society*, April 1, 1916.

Starch, "Educational Measurements," especially chap. III.

Starch, "Educational Psychology," chap. XXII.

Monroe, DeVoss, and Kelly, "Educational Tests and Measurements," chap. VII.

CHAPTER XV

INDIVIDUAL AND SOCIAL ELEMENTS IN SECONDARY INSTRUCTION

1. Individual Instruction

Meaning.—With the introduction of class instruction in the schools, there came the impression that individual instruction was thereby excluded. Class teaching came to be regarded as mass teaching, and the expression "lock-step in education" has been coined to describe the procedure in which the individual is submerged in the whole. To-day we are coming to see that individual instruction is not at all antagonistic to class instruction, for the two may be harmoniously employed in the same activity. Instruction is individual when it is specifically intended for and adapted to individual students, even though two or twenty individuals are being thus instructed simultaneously. Moreover, the difference in needs between different students, although real, is actually not as wide as is sometimes supposed, and the experienced teacher well knows that rarely indeed does the treatment of difficulties raised by individuals fail to assist other members of the class. Efficiency in instruction, as elsewhere, requires that effort expended shall serve as wide a group as possible, and the teacher should seek to utilize the assistance rendered an individual, so that similar difficulties on the part of other students may thereby be brought to consciousness and solution. Individuality in instruction is thus a matter of spirit and character rather than of form.

The basis for individual instruction is naturally to be found in the differences between the individuals to be taught; and upon the recognition of individual differences of students,

whether hereditary or due to environment, depends largely the development of personality through the work of the school. The attention accorded to-day to vocational guidance is but one form of this recognition in a particular sphere, and the part played by individual differences in the entire educational activity demands that they be given a large place in teaching.

Environmental Differences.—Differences due to environment may be taken to include those resulting from the entire experience and training of the child from his earliest years. Naturally these tend to color all his learning and feeling. His imagery, his conception, his application of principles, his appreciation, and even his reason will be largely determined by them. In Chapter VI it was pointed out that one of the functions of the recitation mode of instruction is to secure a certain degree of agreement in the apperceptive mass of the various members of the class, in order that the development of the new lesson may have a definite basis upon which to build. This was but another way of saying that the individual differences due to environment should be so far reduced as to facilitate the work of instruction. However, this must by all means be interpreted not as a levelling-down process but as a levelling-up. The phases of experience upon which the new material is to be developed must in practically all cases be supplemented and corrected, through the medium of class discussion incident to the recitation procedure.

However, it is to the positive rather than the negative treatment of differences that the attention of the teacher most needs to be drawn. Because no two environments are identical, and no two persons similarly disposed toward environment, the experience of each child contains elements which others lack, and which may be utilized as his personal contribution to the work of the classroom. The writer once visited, at Tuskegee Institute, a class exercise in which each individual student reported to the class upon something which he had investigated in the learning of his trade. One

told how he had secured by selective cultivation a profitable variety of corn, another reported upon his manufacture of an anvil, a third upon her learning of the trimming of hats. In a similar way, though with different content, the geometry student in the high school may report upon a new demonstration, the student in history may tell of some book throwing light upon the problem under discussion, and the literature student may contribute his personal interpretation of a stanza or paragraph. Apart from the social value from such contributions by the pupil, there is a real profit in the development of individual capacity through the recognition and use of his particular experience. The value appears less in the material contributed than in the encouragement and training resulting from its recognition and employment.

Hereditary Differences.—Individual differences due mainly to heredity, though fundamentally related to those of environment, demand a very different treatment because they are so deeply ingrained in the child's nature, and are accordingly but slightly alterable. Their investigation is one of the most recent of psychological problems, and much remains to be done before our knowledge of psychical fact can function largely in educational procedure. Hereditary differences may, perhaps, be best classified on the basis of the three traditional forms of mental activity, as differences of intellect, of feeling, and of will, or following Professor Thorndike's more convenient terms, as differences of thought, of temperament, and of action. Of what character and degree are these differences, and how shall they affect the work of the instructor? Professor Thorndike has undoubtedly given us the best general treatment of the subject, and we may well look to him for our psychological data as well as for some of their educational implications.[1]

On the basis of intellectual or thought differences, we might regard students as of two main types, which Professor Thorndike calls the thing-thinker and the idea-thinker. The

[1] Thorndike, "Principles of Teaching," chap. VI.

teacher must see that for the former the idea is connected with the thing, for the other the thing must be associated with the idea. The student who tends to think only of the piece of apparatus in physics, the persons and events in history, the particular verb in French, the given triangle in geometry, should be led inseparably to associate with each its meaning or idea, the principle back of the apparatus, the persons and events, the verb, or the triangle. For the idea-minded student care must be exercised that the learning does not become mere abstraction, but that content and application of the principles are closely bound to the idea itself. Because both types occur in the high school class, both idea and thing must be clearly and fully treated. The procedure earlier studied under the problematic mode, from concrete through abstract to concrete again, provides opportunity for the training of the whole class, though the distribution of emphasis for the individual members of the class varies with their needs, and the teacher must be watchful that neither of the types is neglected in the instruction. If the whole movement be conceived of by the student as one circle of thought, a unit in which both concrete and abstract are united, the danger of individuals being slighted because of the diversity of types will be greatly reduced. On the other hand, any attempt to materially alter the thought-type of a student by high school instruction is foredoomed to failure, if, as we assume, the basis of the differences is laid in heredity, and their form has already become largely established in the years of earlier childhood. Instead, we must realize that they are fundamental in determining his life-work, and the particular trait or talent may, by training, be made a valuable asset in his equipment. Thus the thing-thinker may be enabled to picture a machine or an event with such vividness as to derive added meaning from it, and perhaps portray it more vividly to his classmates. The idea-thinker may develop a most valuable capacity for abstract thought in intellectual fields. Such abilities may well be trained by a suitable

distribution of individual problems, exercises, and reports in the class exercise and assignment.

With the differences in temperament instruction can concern itself much less than with intellectual differences. They are for the teacher more a matter of discipline than of instruction, and can be but little affected by the latter. Adopting Thorndike's classification of them, on the basis of speed, vigor, and range, one might say that the ideal temperament is that which combines all three elements, being quick, strong, and broad, for each of the qualities is desirable when combined with the other two. Extremes of temperament are merely wide variations of degree of these qualities in an individual, combining strength in one quality with weakness in another, and the instruction should seek to strengthen the weaker quality. The slow should be stimulated, the weak invigorated, the narrow broadened. Further, the teacher should aim to unite strongly the feeling element, as the basis of temperament, with both thought and action, so that the individual's feelings will accord with his best thought, and he will neither feel without appropriate action nor act except in accord with a rational impulse. Instruction must rationalize feeling, must train the rationalized feeling to express itself in action, and must inhibit a tendency to act before the implications of action are duly considered. Of the five modes of instruction, probably the appreciation mode offers the best opportunity for the training of disposition, because of the predominance in it of the feeling element. The constant expression of emotional or sentimental attitude both of student and of writer, offers exceptional opportunity for comparison and evaluation of motive, and reinforces the better impulses with the backing of social approval. Further, the content studied provides constant occasion for arousing motives, and their expression in the critical discussion of the class exercise serves to a considerable degree as their idealized application.

Individual differences of will or of action can best be

thought of as giving us two types, the impulsive or impetuous will, and the deliberative or reasonable will. The difference is really one of degree rather than of kind, with a variation from the type in which the individual acts without first stopping to think, to the type in which the deliberation is unduly prolonged, and leads to no choice of action. Evidently, as in all variations due to lack of balance between two opposite tendencies, neither of which is intrinsically bad, the teacher must aim at the strengthening of the weaker tendency, and the temporary inhibition of the stronger until the weaker has time to act. Doubtless the differences of action type are due far less to heredity and far more to habit than is commonly supposed. Frequently, too, the extremes of action type are in part traceable to a lack of intellectual perspective, a failure to properly evaluate the considerations which determine or should determine the course of action. Because habit and judgment thus play a large part in the situation, the efficacy of will training is greater than in the case of temperamental, perhaps of intellectual differences.

Instruction with a view to the establishment of a right balance between deliberation and impulse should strive for three things: first, the habit of inhibiting an impulse until deliberation is possible; second, the proper perspective of the considerations confronting one and the ability to choose rationally after suitable deliberation; third, the habit of reacting rightly when typical situations confront one, and the consequent tendency to respond similarly when confronted by other situations recognized as similar. Opportunity for such training is abundant in all modes of instruction, especially the problematic and appreciation, since these two more than the others involve the students' response to new situations. Attention to the student's answers to questions should, as suggested in the chapter on The Question, demand matured answers, really expressing the best thought of the student. Hastiness in answering, on the one hand, and a reluctance to suggest a positive answer, on the other, are rep-

resentative of the two types of action, and the treatment earlier suggested for such answers is the basis for that of the two extremes of impulsiveness and extreme deliberation respectively in so far as high school instruction is concerned. For the initiation of the habit sought it is often necessary to reinforce the new habit by means of a somewhat severe stimulus. For example, in the case of the impulsive type, hasty action should be followed by unpleasant consequences, immediate enough and long enough continued to insure their certain and prompt functioning before the impulse can be acted upon when the occasion again arises. In the case of the deliberative type it is well to compel immediate responses to situations, yet not relieving the individual from the responsibility for the results of his action, for irresponsible haste would be either ineffectual or harmful in its results.

The Teacher's Attitude Toward Individual Differences.—Our study of the treatment of individual differences raises the question of the instructor's general attitude toward such differences, and has implicitly suggested the answer. Shall the attitude be a positive or a negative one? Shall he encourage or discourage differences? The answers given in the various cases above may be generalized in a comparatively simple principle. Determine whether the trait in question can be of service to the individual in life, and, if so, what degree of it will be of most service. If its value is negative, reinforce the impulse or capacity which will restrain it. If positive, facilitate its development to its proper degree. If there is danger of excess, reinforce the opposing impulse or capacity to establish a proper balance between the two. Thus the utilization of forces already present rather than the suppression of undesired ones or the creation of new, the rationalization of these forces by intellectual training, and their establishment in the form of correct habits are the three principles which in the treatment of individual differences must control instruction. Quoting from Professor Thorndike: "The one thing that educational theorists of to-day seem to place as the fore-

most duty of the schools—the development of powers and capacities—is the one thing that the schools or any other educational forces can do least. The one thing that they can do best is to establish those particular connections with ideas which we call knowledge and those particular connections with acts which we call habits." [1]

Important as is the matter of individual differences in education, there is still some danger of exaggerating its significance for method. Appalled by the vast array of possible combinations and degrees of differences among the pupils of his class, the teacher may despair of adapting his method of instruction to them all. Factually the case is not so hopeless after all. Among high school students variations are seldom extreme, and the desirable traits are usually fairly well correlated, so that really the class consists mainly of a group the members of which differ but slightly, and demand comparatively slight differences of treatment.[2] Moreover, the fact that students respond differently to a situation does not necessarily mean that the situation must be differently presented to them, but rather that the different responses shall be recognized and, so far as possible, be so directed as best to utilize the differences represented.

Specific Forms of Individualizing Instruction.—We have been discussing the general principles which should govern in individual instruction in all its phases. A few suggestions regarding some particular forms of such instruction may be of profit. Business houses have long since learned the importance of "following up" their general advertising with individual attention to prospective customers. Elaborate systems of indexing have been devised for the administration of systematic correspondence and visitation, with the hope that even a small portion of the efforts may bring results. With a much smaller group and immensely greater chance of success, the demand for a "follow-up" system in instruction seems

[1] Thorndike, "Educational Psychology," vol. III, p. 314.
[2] Thorndike, "Educational Psychology," vol. III, pp. 362 *ff.*, 374–375.

not only rational but imperative. Classroom application, study period, laboratory instruction, and personal conference all afford an opportunity for profitable systematic "following-up" instruction which has hitherto been neglected, or at best desultory. Why might not a simple card index, involving an intelligent adaptation of business methods to individual instruction, be an appropriate article of desk equipment for the teacher's study?

In the classroom application the use of blackboard or of written work affords the instructor his best opportunity for observing the individual needs of all his pupils at one time. Because it involves all of them, and for a comparatively short time, its systematic administration is of vital importance. Elaborate and prolonged instruction of one or two individuals is obviously wasteful when the needs of the group are overlooked, and should be deferred to the personal conference. On the contrary, attention should first be given to a general oversight of the entire group, primarily to the points left obscure by the lesson development immediately preceding, and to principles rather than to details. If the development of the lesson is found to have been inadequate, the time for the remedy of the difficulty is then, before the class undertake the further application in the outside study. If details of procedure are attended to at the expense of principles, the many will suffer in the gain of the few. On the other hand, this must not be taken to justify the neglect of accuracy or detail, but rather its subordination to the general principle (save when it is itself the chief aim of the lesson), and the deferring of it to personal conference in case it and the general principle cannot both be adequately dealt with.

Laboratory instruction in its various forms affords a much better opportunity for dealing with individual needs than does the class exercise. This is due partly to its more informal character, partly to the longer period involved. Because the use to which one can put his knowledge is a final test of that knowledge, the laboratory affords the instructor

a most favorable opportunity to discover the adequacy of his classroom instruction. He must be watchful not for results alone, but for methods, and by occasional questioning find out not merely the *how* but the *why* of the student's procedure. Much so-called laboratory work, in library, laboratory, or field excursion, is largely imitation, and only by individual questioning, possibly at intervals during the procedure, can the student be brought to a real consciousness of what he is doing.

The study hour, because of its peculiar function of developing self-reliance, and of the necessity of avoiding distraction for the group, offers somewhat less opportunity for individual attention. On the other hand, the advantages which should result from the meeting of individual needs as they arise rather than in the next class exercise, justify the teacher in undertaking more than mere police duty in the study hall. The modern movement toward supervised study, discussed in Chapter XII, is beginning to yield very positive results, and though the movement is still in its infancy and the methods still to be worked out, the high school teacher must come to realize that the lesson preparation under supervision offers splendid opportunity for the individualizing of the instruction, which in the class exercise must necessarily be largely general. The individual work of the study supervision obviously provides the best basis for the "follow-up" work above suggested.

The value of the personal conference has already been referred to in connection with the examination. Not merely does it give the personal acquaintance and sympathy which render all teaching more effectual and inspiring, but it, too, affords peculiar opportunity for the "follow-up" work of instruction. Here the needs of individuals can be discovered and met, and the efficacy of the succeeding class exercise very greatly increased. The conferences need not always include a single student, but groups with similar needs may often be called in conference, with the added advantages of

economy of time and opportunity for mutual helpfulness. At such conferences the rule "business first" need not imply "business only," for the creation of a favorable mood and the impression that the teacher is not merely an instructor are valuable conditions for teaching.

Teacher Assistance and Individual Instruction.—Our discussion of individual instruction may well close with a word of caution which, losing none of its importance because often spoken, concerns all forms of individual instruction. School instruction is to develop ability, not to secure certain particular answers, and the teacher must be on his guard lest in his attempt to assist the student he assist him to get answers rather than ability. The instructor must not do the student's work for him, but should rather aim to increase his power to the point where he can do it himself. If a problem is such that the student's ability cannot be made adequate for it, the problem is unsuited to him, and might better be omitted. The injunction, "Do nothing for the student that he can do for himself," would better express our thought if taken to mean, "Do for the student nothing which it would be worth his while to do for himself." Occasionally telling him something which he could have found out for himself may be a real help, if that finding out would, through distraction of his attention or his lack of skill, have prevented or seriously hindered the accomplishment of something else more profitable. Not merely values but relative values must be reckoned with.

2. Social Instruction

Meaning.—The responsibility of the school for the education of the child for his own individual good has long been recognized. However, society has a right to expect more than this. The school is society's chief agency for the socialization of its future members, and cannot fulfil its function unless it trains the rising generation for the responsibilities as well as the privileges of social membership. Because the

secondary school deals with a type of students more advanced than that of the elementary school, and intellectually better fitted for leadership, the demand that it shall recognize the obligation of social training is peculiarly urgent.

In the preceding section we applied the term individual instruction to instruction of the students as individuals, and for the sake of meeting individual needs. With equal justification we may employ the term social instruction for that type of instruction which is given to the students as members of a group, and for the specific purpose of meeting social needs and developing social relationships on the part of the members of the class. In both cases only those phases of the problem are considered which are directly involved in secondary teaching. With the philosophical as well as the administrative problems of social education we are here only incidentally concerned. At best our present study can be but incomplete, because the application of sociology to secondary education is itself a field in which very little has yet been done.

Aims.—The discussion of the problem of social instruction in the secondary school naturally resolves itself into a twofold one, dealing with the aims of social instruction and the ways in which they can be attained in the usual school instruction of class exercise, laboratory, and study hour.

Social differs from individual instruction in aim and method, but the difference is not a sharp one, and the difference must ultimately be based upon the training of persons rather than of the group as a whole. Social purposes and social procedure are to be employed in the training of the individual. His social needs are to be met, his social relationships realized; he is to be socialized. Social instruction, therefore, must ultimately be of boys and girls, not of the class as such; it must be particular and specific, not general and indefinite, for the character of the class is determined by that of its members acting in a group, and the social training of the class is the training of its members in their social activi-

ties. Accordingly, our problem will be the statement of the aims to be attained by social instruction, and the methods of their attainment through the training of the students who constitute the group.

In Chapter III four aims of education were suggested: social intelligence, social disposition, social efficiency, and social habit. Sharp differentiation between aims is impossible and useless. It is far less important that they be mutually exclusive than that they be all-inclusive, taking account of all the requirements of social instruction. The adequacy of the formulation is guaranteed by its recognition of the three forms of mental activity, as well as of the permanence of their function.

Social intelligence naturally involves in the first place an understanding of the social curriculum, but viewed from the distinctively social angle. Each subject which is or should be in the high school curriculum has its social implication, although as commonly taught such implication is but little if at all realized by either teacher or pupil. The student usually feels that education is a possession which he is earning, and is, therefore, to be used for his own advantage. Accordingly, the individualistic aim so pervades his study that the social phases of the various studies are seldom noticed. Probably civics, history, and current events contain the most obvious social content, since all deal with the organization of society as it is and in its development. The sciences, including the physical, biological, and mathematical, and especially the vocational, all make a real social contribution, principally through their economic applications. Literature and language study are to-day coming to be taught as a means of interpreting the social feeling and ideals of the race. Manual training and domestic science have a real economic value, and share with physical training and hygiene in their service to the social institution of the home. The specific social content and method of each of these studies are problems for the courses in the special methods of the respective subjects.

Our concern here is with the general social aim to be realized in them all, and its significance for the work of instruction.

A second form of social intelligence inseparably connected with the above is the knowledge of society. Sometimes implicit in the curriculum study, sometimes explicitly offered as extra-curriculum instruction, it may be provided either unconsciously or consciously on the part of the teacher. It must involve a first-hand knowledge of actual society, and especially that society of which the student is a part, both within and without the school. The curriculum specifically teaches him *about* society, which is good so far as it goes. This must, however, be supplemented with an intelligent social experience. Coming often from homes where such matters are practically ignored, he must, tactfully and considerately, be taught the conventionalities and proprieties which society demands, and should be shown how they are usually not arbitrary, but have been evolved for the preservation and improvement of society. Thus he can be led to criticise and evaluate the motives and forces which are active in the society in which he is to have a part, and later in his high school course may profitably undertake a formal study of elementary social ethics.

The third form of social intelligence is the understanding of oneself. It is not enough that one know about society in general and have first-hand knowledge of his own immediate social environment in particular. Since he is to participate actively in the latter, and to gradually extend his participation to embrace more and more of the former, he must know his own personal function in the social body, involving a knowledge of his capacity, his needs, and his own peculiar social opportunities and obligations. He must see what are his particular talents, and how these can by adequate training and direction be adapted to the social opportunities which surround him. He must be made to realize his deficiencies, and his obligation to society to remedy these

in so far as possible, and render himself a more valuable member of the social group.

Social Disposition.—The second of the four social aims is, doubtless, the most difficult to secure. Neither teaching one about a form of action nor compelling him to perform it repeatedly nor capacitating him for its performance will cause one to want to do it. Intelligence, habit, and efficiency do not necessarily insure disposition, though vital for its proper functioning. Even a desire on one's part for a social disposition will not suffice for its acquisition. One cannot like a certain person, or want to do a certain thing, because he wants to like or wants to want. Disposition cannot be driven but must be led, and led tactfully. And yet it is not on that account wholly beyond control. We go to hear inspirational discourses on moral and religious themes because we know that as a result we will more earnestly desire to do the right. We seek to select the adolescent's reading and associates because we realize the control these exercise over his disposition toward the best things of life. The truth seems to be that the student is influenced far more by persons and things than by principles, and the foundation for social disposition must be laid in the concrete and personal rather than the abstract.

The content of study, in order to have a social force, must be adapted to the student, lying within the range of his interests, and having a vital significance for him. In civics the study of the election of the mayor has more training value for social disposition than that of the state attorney-general, because it is closer to his own experience and its social implications are more real to him. Quite as important is the form of its presentation, which must lead from concrete things of the student's experience, and must make its first appeal to the interests and motives already active. In the instance just mentioned the social disposition in state affairs can best be attained by starting with those of the city, in which the boy is already interested, and broadening that interest until it includes the more general and remote. In so far as the sub-

ject permits it should be given in terms of action. The student is but little concerned with mere facts about the office of mayor, but what the mayor does, and what he himself may have to do with the mayor's election, have for him a real social appeal.

The choice of content is, for the development of social disposition, far less fruitful than the manner of its teaching. Social disposition is itself a matter of attitude, and the attitude assumed toward any instruction is largely determined by that of the instructor. Just as many students like a study because the teacher of that study is friendly, so the entire environment has its influence on the disposition of the student toward what he learns. The teacher's personal manner toward his pupils and his work is peculiarly influential, because they, consciously or unconsciously, look to him as a leader, and tend to assume the same attitude that he does. The mood of the child also determines greatly his response to situations and obligations. For example, public criticism for a breach of courtesy may easily render the child antagonistic toward all social conventionalities. Thus, the choice of time and conditions of social instruction may well receive consideration. Social sentiment is another powerful factor, and every teacher knows well how the approval or disapproval of the group affects the attitude of the individual member of the group in matters of his social relationships. Attempting to train a boy to be polite and considerate when the group considers these qualities effeminate can seldom extend beyond perfunctory conformity, with no changes in the social disposition. Since groups regularly follow leaders, a wise plan is, when possible, to bring the leaders of the groups to assume a right social attitude in their leadership, and the powerful force of social sentiment will soon follow to reinforce it. Sympathy between the teacher and his pupils will result in his being one, and the chief one, of those leaders. In the same way the students should be taught to recognize good leaderships and good society, so that in later years the social

sentiment to which he responds will be that which is in harmony with his highest ideals. Naturally, social disposition is inseparable from moral disposition, in both origin and function, and the demands of social life furnish reinforcement for moral training. In the words of Professor O'Shea, "The pupil must be led to see the social necessity for every moral attitude urged upon him." [1]

Social efficiency, our third aim, is by no means distinct from the other three, and is by some writers taken as inclusive of them. The word "efficiency" suggests the ability to bring things to pass, to put ideals into realization. The efficient person is one who can be depended upon to do the right thing, and in the right way. Certainly social knowledge and disposition contribute to social efficiency, and perhaps it may be thought of as constituted by the synthesis of the two elements functioning as a unit. For our purpose, however, its importance lies in its peculiar emphasis upon action. Instruction's part in securing social efficiency culminates in its binding appropriate action to knowledge and feeling, the application to the principle. This implies that following up the teaching of social relationships and obligations in the classroom there should come at once their realization, as truly as in the teaching of mathematical operations or scientific principles. Moreover, the instruction should be such that the self-government and social life of the school are forms of its application, and not wholly distinct from it, as is usually the case. The principles that are to control conduct should not merely be idealized in the classroom instruction, but should find there their first application, and as expression is a step toward application they should be expressed there as well. The intellectual training derived from the class instruction in English composition may be given social application in contributions to the school paper, and the geometry may be put to use for common good on the planning of the running track or tennis court, if prompted

[1] O'Shea, "Social Development and Education," p. 269.

by the right spirit. Thus there will be built up a connection whereby the social conditions of the class work will provide the basis for social instruction, which under the impetus of social disposition will lead to classroom application, and thence spread to the other school activities, and thus into the later life of the student in the outside world.

Social habit is to social disposition what the flywheel is to the engine. The social impulse, like the impulse of the steam in the cylinder, is not constant, nor are the obstacles it is to encounter or the load of the engine always the same. In either case steadiness of action is vital, and is secured by the momentum of the social habit, in the one case, and the flywheel in the other. If, as ethics teaches us, character is "a fixed habit of will," social character is such a fixed habit of will, and the possessor of a good habit has, using Professor James's apt phrase, a most helpful ally in life's battles. The high school graduate, encountering the situations of life without the immediate assistance of the school environment and influence, will often be called upon to choose lines of social action in the face of strong antisocial influences. It is here that habits acquired in the school training give him a momentum to reinforce the otherwise inadequate social impulse, and the resultant choice is rightly made.

In an earlier chapter[1] the laws of habit formation were given as two, which we called the laws of initiation and fixation. First give a new habit as strong a motive as possible, and then repeat the activity until it is thoroughly established. In the forming of social habits these principles hold. Having given the student the initial motive, by adequate intelligence, disposition, and efficiency, the social conduct must be fixated by repetition. This would involve such an organization of the school that the student would continually be called upon to act upon his social ideals, in the permanent forms of self-government, social organizations, athletics, and the like. However, our present problem is that of instruction, which should be basal for the other phases of the school life.

[1] *Cf.* p. 85.

The various activities of the classroom, such as passing to the board, collecting of papers, and, still more important, the assisting of fellow students and teacher and co-operation with them in common undertakings, and all that the term *esprit de corps* implies—all these furnish abundant scope for the establishment of social habits. Thus, in the conduct of the class exercise, the laboratory, and the study hour, opportunity should be sought for the frequent and repeated doing of the thing desired to habitualize. Many of the difficulties encountered in administering student government and life outside the classroom could have been escaped had the social habits been initiated in the class exercise where instruction and guidance can play a large part.

School Agencies for Social Instruction.—What agencies has the high school at its service for the realization of these four social aims just discussed? Perhaps it might rather be questioned whether there is any phase of the school activity which does not afford opportunity for social training, for not infrequently the activities most mechanized and devitalized could, if properly utilized, be made to render the most helpful social training. With our field limited to the primarily instructional rather than the administrative phases of the question, there naturally suggest themselves to us the three agencies already studied: the class exercise, the laboratory in its various forms, and to some degree the study hour. How these may be so conducted as to realize the social aims constitutes the second part of our problem of social instruction.

The class exercise is naturally the centre of the school life, socially as well as intellectually. In Chapter IV we quoted Professor Dewey's reference to it as "a social clearing-house, where experiences and ideas are exchanged and subjected to criticism, where misconceptions are corrected, and new lines of thought and inquiry set up." With accent upon its social aspect, it might be described as a social clearing-house, where capacities and interests are pooled and put to the test of service, where non-social traits are corrected and

new fields of social endeavor discovered. For the realization of such an ideal the formal character of the typical classroom procedure is ill adapted. For military manœuvres where identity of action under command is the goal, ranks and files serve a purpose, but not for the classroom, and the checkerboard alignment of immovable seats is being displaced by the grouping of the students about tables, or in other arrangements conducive to the social spirit which should dominate. This does not imply the substitution of chaos for order, for there must always be system and method of procedure where several persons are to work together. It is rather a substitution of form for formalism.

This reform in seating plan is but a minor phase of the needed reform in the general classroom procedure, with the idea of the class exercise as a reciting to the teacher, where the teacher asks questions of individual students and the student gives his answer to the teacher alone. Not merely should the teacher's question be addressed to the whole class, but the answer should likewise be an answer to the class, not to the teacher only, and spoken loudly and clearly enough for all to hear. The central thought should be that the class is a social group working for a common end, and that what is correct in good society generally is the correct thing for the classroom. Carelessness in the thought or in the expression of what is said should be resented by the class as a slight, and the force of social sentiment brought to bear upon the offender. In similar manner, a piece of class work well done should win the approval not merely of the teacher but of the group.

All this is possible only on the basis of a social consciousness, a feeling of solidarity, which is an essential for the social participation of adult life, and is far more easy to secure with adolescents than might at first be supposed. The same force which makes high school students want to manage their own athletics, debating and literary organizations, and which makes student self-government successful can, with equal

justification, though to a less degree, be utilized in the classroom. The sense of proprietorship, the zest of self-control, the feeling of responsibility, or the spirit of self-reliance (call it what you will) is strong in the youth, and under guidance can become possibly the most valuable acquisition of his high school days. Yet guidance is necessary in an unfamiliar territory, and in the work of instruction, at least, the youth will seek it, readily acknowledging his lack of knowledge and training. Thus, in the properly organized class group the teacher becomes the acknowledged leader in the instruction, a leader by virtue of recognized merit rather than by force of the school authority, which is kept in the background. In a sense the teacher becomes the property of the class, to be used for the good of the group, and all the more valuable property because a person rather than a reference book or apparatus.

The fundamental principles of the social organization of the class instruction are thus seen to be two: student co-operation and teacher leadership. The concept of teacher leadership implies that of student self-activity. It suggests that in each student there is in all the instruction process a degree of initiative. Thus viewed, the tendencies toward unthinking conformity, known as suggestion and imitation, are antisocial to the degree that they involve non-critical acceptance and following of authority or prestige. A recognition that the teacher is probably right, and a desire to understand why, are the better and more social forms of suggestion and imitation. The concept of the student's mutual co-operation implies a disposition to help one's neighbor even at the expense of personal convenience. Thus viewed, the employment of emulation in instruction is dangerous in its tendency to place a premium upon the failure of others. A desire to excel because the thing is worth the effort made, and a realization that success in the competition is most commendable after helping one's competitor to do his best, are the social correctives in emulation.

Forms of Socialization of Instruction.—These two fundamental principles of the socialized class exercise are easily formulated and readily accepted. The ways in which they are to be applied in practice are neither simple to devise nor universal in form. The degree of student responsibility in the instruction ranges all the way from almost none to almost complete, depending much upon such factors as the maturity of the students, the character of the work, the size of the class, the equipment of the school, and, most of all, the attitude of the teacher and principal.

The most conservative form of socialization of instruction is that in which student responsibility in instruction is limited to their mutual co-operation. Here the central thought is that of mutual helpfulness. Students are naturally willing to help one another when their attention is called to the possibility of so doing. The chief difficulty is thoughtlessness and inexperience. Showing them how, calling attention to the need, assigning a particular task, and making it a regular part of the instruction are respectively but the concrete application of our four aims: social intelligence, social disposition, social efficiency, and social habit. The teacher is prone to think that he alone must do for his students all that is done for them. Even if he can do it more skilfully, there is lost the greater benefit to both helper and helped which results when one member of the group assists his neighbor or neighbors. Moreover, it sometimes happens that a student better appreciates the difficulties of his fellow because of a greater nearness to his intellectual level, and can touch the vital point overlooked by the teacher. On the other hand, pupils are likely to mistake the character of helpfulness, thinking it consists in facilitating the getting of answers instead of developing power. Attention given to showing the class the real aim in instruction, and giving them the responsibility for the quality of help they render, adds greatly to their efficiency in more ways than the one for which it is primarily designed.

The classroom may very well adapt and adopt the team work of the athletic field. The ability to work with one's fellows is an important element in efficiency, and may well be cultivated in the class exercise. Forms in which it may be developed are the debate and the joint report by several, or even all, of the members of the class. Here each must co-operate with the others for a common end, and without "playing to the grand stand." The success of the group is his success, and its responsibility his responsibility.

The spirit of helpfulness may serve to give a new significance to an activity commonly employed, but sometimes with an antisocial influence. The classroom has been repeatedly referred to as the place for the exchange of ideas, where they may be amplified, clarified, and corrected. When this is done by the teacher, it loses its special value. When done by fellow students, it may take on the character of fault-finding and picking of flaws, with the "I-know-better-than-that" attitude. Not only the abler but even the weaker student joins in the smile of superiority at the expense of the mistaken one. When the spirit of helpful criticism prevails, each seeks to remedy the shortcomings of his fellows, sharing in the regret at his deficiencies and the gratification over his successes. Thus the class comes to experience such a sense of solidarity that it feels the successes and failures of its individual members to be the successes and failures of the group, just as the whole school boasts of its athletic team's victories and condones its defeats.

The three preceding paragraphs suggest to us the three forms of responsibility which function in the mutual student co-operation: responsibility of the class to the individual, responsibility of the individual to the class, and responsibility of the class for the individual.

In the realization of these responsibilities the student "finds himself" socially. Thus he comes to discover his ability and his obligation to serve society. The division of labor incident to co-operative group work will naturally be

based upon the group's estimate of his fitness. Herein he will find a social incentive to rise to his best capacity, and to develop his peculiar talents through and for the service of the group. What is especially important, he will work under conditions and be prompted by motives closely parallel to those of adult society rather than those of mere obedience to authority. A good foundation for social membership will have been laid.

A more radical form of socialized instruction is that in which the student responsibility extends to actual participation in the instruction, not merely in mutual co-operation, but directly in that they undertake some of the teaching itself. This may even extend to what might be termed student direction of the instruction as well as mere student participation in it. Some attention has of late been attracted by the advocacy of a plan whereby the teacher becomes a spectator, and the conduct of the class is placed in the hands of a student leader.[1] The leader calls upon some student for a topical recitation upon a point in the lesson assigned, and the other students take the attitude of critics. Each student is responsible to the class for the justification of his criticism, as well as for the supplementing of what has been recited. Further topics are suggested by leader or class, until the lesson has been recited upon or the period has expired. Such a plan has several points in its favor. It develops the initiative and responsibility of the class, trains in respect for and co-operation with the authority of even a member of the group, exercises judgment in the evaluation of the lesson material, both as to accuracy and relative importance, and awakens general interest, at the same time giving much of the training in oral expression incident to topical recitation. The name under which it is often advocated, the "socialized recitation," is not inapt. It certainly is socialized, combining as it does so many of the social elements we

[1] Such a plan is described in the *School Review*, vol. XVII, No. 255. A modified form of the use of monitors in teaching is suggested by Parker in his "Methods of Teaching in High Schools," pp. 382 *ff*.

have mentioned. Unfortunately, the word "recitation" is also apt, for when immature students have the direction of the class exercise it is prone to resolve itself into a mere recitation. For the development of new material it is manifestly unsuited, since in view of the immaturity of the students it would involve the "blind leading the blind," and the waste of the most valuable educational asset of the class, viz., the teacher's training. For an occasional variation in the conduct of the recitation instruction upon comparatively simple content, it has been found admirable.

Student participation, stopping short of full control, is far more available and safe. Students enjoy having a share in the work of instruction, even though it extend no further than the supplying of materials. As illustrations of such participation might be mentioned the collecting of science specimens and materials, loaning of books and magazines, and bringing of pictures for illustrative purposes. Volunteering to secure some desired information, to work a problem for the class, or to prepare a report or discussion on some desired topic would be helpful participation in several ways. The selection of particular students to prepare for the class a description of what was seen on a field trip, the demonstration of a proposition, the translation of a passage, or a character-sketch of an author studied in literature would illustrate such participation especially well when the emphasis is laid on the assignment as representing the class through the very best that one of its members, perhaps its best qualified member, can do. The central thought permeating it all must be that of assisting in the instruction, not that of meeting the demand of the teacher. Teachers may occasionally, with great social and instructional profit, suggest to the class that through their chosen representative, assisted by the group, they explain to one of their number a problem which baffles him. Explanation in such a case has for the students a real function, and they discover better than in any other way what constitutes good explanation.

Encouraging students to suggest topics for study and problems for solution encourages a responsibility for their contributions, for they soon discover the loss and difficulty resulting when the choice was thoughtlessly made. Further value lies in the fact that such problems are usually real ones for the class, and will be more earnestly attacked because they feel a measure of responsibility for them.

The laboratory instruction, as the second of the agencies for the realization of the social aims, has a peculiar opportunity in the greater liberty of the students, and hence in the greater responsibility that accompanies that liberty. The form of procedure is that of the workroom, and the rules that govern are those best adapted for the good of the group, unhampered by tradition. Since the laboratory, in its various forms, is thought of by the student as a place for work, with responsibility for results, he readily recognizes the importance of good working conditions, unhampered by the mischief or thoughtlessness of his fellows. Naturally the degree of restraint in the laboratory instruction depends upon many factors, varying from the great liberty of the field excursion to the greater self-restraint and quiet of the library, and the student can quickly learn to adjust himself, thus developing thoughtfulness and self-control. The training thus provided in adaptation in work to the rights of others is, in itself, one of the important social lessons of the school. The field excursion by groups, or of the entire class, may take on in a measure the character of social service when, at the expense of real effort, specimens are collected for the school museum, or even one quite apart from the school, perhaps of another less favored school.

Because of the greater degree of individuality in its work than in that of the class exercise, less opportunity is offered for co-operative effort on a common task. In library work there is practically none. Some is offered in the school excursion in a systematic division of effort in the search for specimens, investigation of land formations, and preparation of a

joint report upon observations. In the school laboratory itself an experiment or observation may be made by the class working together; for example, in the quantitative work in physics the average of all the results obtained by students may be employed as the basis for further experimentation. Different students in biological work may undertake the observation of different features of a single plant or animal form, and the results of all be united in a joint description to be entered in the notebooks of all. Still more frequent will be partnership work wherein two work together upon a problem, the results of both being united for a joint report. A social value in all these cases lies in the responsibility of each student for the accuracy and adequacy of his results, since his failures become the failures of the group, and all suffer or profit with him.

The study hour offers far less opportunity for social instruction. The facts that study demands quiet and that its chief feature is independent work leave but a narrow range for social work as directly connected with instruction. What there is enters largely in the self-restraint and thoughtfulness of one's fellows, which the pupil in his study demands from others, and in turn learns to accord them. He learns to do things in an orderly manner, not for the sake of himself but for that of others. To some degree, and under proper management, students may be encouraged to assist one another in the preparation of lessons, though there is danger of so doing resulting in more harm than good, mainly through disturbance of neighbors and lack of oversight. A social value of a different sort is derived from the training of self-reliance in work, encouraging the pupil to master his difficulties himself rather than disturb pupils or teacher unnecessarily. The occasion may be utilized for suggesting to pupils the application of the same principles to the study done at home in the midst of the home circle. Social training whose influence does not reach beyond the school walls and the school hours falls far short of its true aim.

3. The Relation between Individual and Social Instruction

The relation between individual and social instruction has too long been thought of as one of antagonism, and from this interpretation has arisen a disposition to assume that one of the two must be sacrificed for the other. If individuality means the sacrifice of one's neighbor's interests for one's own, it is antisocial. If social instruction means the submersion of personality in the mass, it negates the individual. However, neither meaning is correct. The truly social is that which is based upon the personality of the individual members of the group, and the truly individual is that which is possible in its completeness only as a part of the social unity.

As the teacher faces his class of twenty pupils, what shall the group mean to him? He may view it as twenty repetitions of the typical student, or he may regard it as twenty adolescents whose relationship is merely that of all of them being students of the same subject at the same time and place. Either interpretation is inadequate. No two students are duplicates, interchangeable like the pawns on the chessboard. Neither are they unrelated, free to move about the board independently. Instead, they are the major pieces, kings and queens, bishops and knights and rooks. To the chess-player these constitute a unity, a system wherein each plays a peculiar part, often widely different, often very similar, yet always related each to each. Personify these chessmen, making them consciously and purposively participative in the play, and we have a reasonably accurate picture of the class as the teacher sees it before him.

Frequent reference has been made to the response of the student to situations, both intellectual and emotional. Because no two persons have the same background of experience or of heredity, because their intellectual and emotional needs and interests differ, these individual differences will lead to

differences of responses. Naturally each response, as the meeting of an individual need, has its individual value. At the same time a potential social value lies in the variety of the responses, in that each contributes a distinct viewpoint and interpretation of the environment and of life. The experience of every man is richer because of his contact with another man, who responds differently to situations that confront both. Thus we saw that a leading function of the class exercise is its provision for exchange, comparison, and reconstruction of ideas, ideals, and attitudes. Individual study leads the pupil to train his own knowledge and feelings, but since he is to be a part of the social group, society demands that he shall adapt these to the social knowledge and feeling and resultant action.

This is not a process of substitution, but one of expansion. Nothing of his own is really lost, but all goes to shape the intellectual, emotional, and volitional life of the group. As a member of society the individual is under obligation, both on his own account and on that of society, to contribute and conform. However, the conformity is neither repressive nor absolute. Rather it is the broadening of the individual's interests, his intellectual and emotional wants, until they have become social interests, and he shall want for society what society needs, as well as want for himself what he himself needs. Further, he shall have been trained to work with society in the attainment of society's wants, contributing his individual talents in the rendering of his individual part in the attainment. He shall remain an individual while becoming social.

This discussion of the relation of the individual and social aims is implicitly a discussion of the relation of individual and social instruction. The former is instruction directed explicitly to the training of the individual's talents and capacities, the latter is instruction which seeks to bring these talents and capacities into social service. Complete instruction thus involves both individual and social, and not as distinct but

as aspects of a single process. Thus viewed it will seek to develop individual initiative in responding to social demands and ideals.

Individual instruction is the recognition and development of desirable individual differences. It is a process of differentiation. Social instruction consists in adapting and adjusting together the members of the group to form a unity which we call society. It is a process of integration. The differentiation must culminate in the integration. Society can be organic only when each individual plays his part, and that part, determined by his individual talents and traits, must be developed with a consideration of their function in fitting the individual for social participation. Education's task is the development of these individual talents and traits, and the individual's adaptation thereby for taking his place in the social whole, contributing to the whole because of his individuality, benefiting individually because of his social participation. In this broader function of education individual and social instruction find their unity.

4. Summary

Individual instruction is complementary to social instruction, not antagonistic to it. Its basis is in the individual differences of pupils, resulting from both environment and heredity. Environmental differences are to be met by providing opportunity for each pupil to utilize his peculiar advantages and experience in his school study. Hereditary differences of pupils are of three classes: of thought, of temperament, and of action. Differences of thought type are to be met by giving each pupil, whether thing-thinker or idea-thinker, such special attention in the concrete-abstract-concrete movement of thought as to develop that phase of the thought wherein he is deficient, as well as to develop to the fullest usefulness the latent possibilities of his particular mental make-up. Temperamental differences call for such

individual treatment as to develop quickness, strength, and breadth, linking feeling with thought and action. With the differences of action-type, the teacher must aim to establish a balance between impulse and reflection. In all efforts at individual instruction, whether in classroom, study period, laboratory, or personal conference, the central aim must be to build upon student activity, by providing it opportunity and guidance as study of individual needs may dictate.

Social instruction must secure social intelligence, social disposition, social efficiency, and social habit. Social intelligence involves a knowledge of subject matter of the curriculum in its social implications, a knowledge of society itself, and an understanding of one's relation to society. Social disposition implies an attitude toward the claims of social obligation, and is based upon appropriateness of educational material and a right personal relationship between teacher and pupil, and between pupils. Social efficiency, or the capacity to realize social ideals, demands opportunity and encouragement in their realization in the life of the school. Social habit implies the motivation and the fixation by repetition toward social action. The socialization of instruction in classroom, laboratory, or study period is based upon the two principles of student co-operation and teacher leadership, permeated with an attitude of mutual helpfulness and consideration.

The relation of individual and social instruction is one not of opposition nor of independence but of close co-ordination. True individual instruction recognizes individual differences and capacities as the foundation of personal development, and social instruction is based upon a recognition of personalities as social assets, and a synthesis of them in social action.

QUESTIONS FOR DISCUSSION

1. To what degree should the teacher permit the pupil to specialize along the lines for which he is most adapted, rather than to attempt

the development of his other possibilities by studies which train in the latter?

2. Is there danger that suggesting to pupils their peculiar aptitude toward certain lines of work will tend to induce an attitude of neglect for other capacities?

3. Show how the supervision of study offers peculiar opportunity for individualizing instruction.

4. How does the Batavia System (described in Bagley's "Classroom Management," chap. XIV, and in various other publications) provide for individual instruction? Does it tend to unduly accentuate it?

5. Which of the social aims of education are best attainable by the study of history? Civics? Manual training?

6. Does social training come more from the content or from the method of study of the secondary school subjects? Why?

7. Suggest ways in which the attitude of responsibility of the class to the individual, of the individual to the class, and of the class for the individual may each be developed.

8. In so far as your experience goes, do teachers tend to emphasize the social or the individual aspects of education? How do you account for the emphasis which you think exists?

SUPPLEMENTARY READINGS

Thorndike, "Principles of Teaching," chap. VI.
Bolton, "Principles of Education," chap. XII.
Parker, "Methods of Teaching in High Schools," chap. XV.
Holmes, "School Organization and the Individual Child," chaps. V, VI, VII, VIII.
Strayer, "Brief Course in the Teaching Process," chap. XII.
Howerth, "The Social Aim in Education," in the "Fifth Year Book of the National Herbart Society," p. 69.
Betts, "Social Principles of Education," pp. 305–313.
King, "Education for Social Efficiency," chap. XIV.
King, "Social Aspects of Education," chap. XIV.
Johnston, "Modern High School," chap. VIII.

APPENDIX

LESSON PLANS

These plans are not given as models. Rather, they are intended merely to show how successful teachers have planned and taught lessons, and thereby to be of suggestive value to others. The plans have necessarily been rewritten to adapt themselves to our purpose. Many points of personal or local significance have been omitted. Much in the way of detail and of pedagogic explanation has been introduced. To some degree the terminology has been modified to conform to that we have adopted in our text.

In these lessons the amount of material covered is, in most cases at least, to be taken as the maximum possible with favorable conditions, such as well-graded classes, thoroughly prepared assignments, and strict economy in use of lesson hour.

PHYSICAL GEOGRAPHY

Lesson developed yesterday: Changes in river valleys, due to erosion.

Assignment for to-day: Text-book treatment of same, supplemented by readings on various typical river valleys. Probably a laboratory exercise on river valleys, possibly a field excursion to some typical valley has been introduced since last lesson, with attention called to the phenomena to be studied in to-day's lesson.

Lesson to be developed to-day: The disposition of stream erosion products.

Aim of lesson: Knowledge of the formation resulting from deposition of sediment. Training the observation and interpretation of physical phenomena of environment.

PROCEDURE

CONTENT	METHOD
	Recitation
Fundamental features of a river valley.	"What do you understand the term 'river valley' to include?" Have students point out the extent of a few river valleys upon a relief

map. Recall, by questioning, the general form of river valleys; transversely, and longitudinally.

Factors determining the course of a stream: lowest level, obstruction, character of soil.

"What factors determine the course of a stream?"

Surface erosion.

"How does the surface water, in its movement toward streams, affect the surface of the ground?"

Erosive factors in streams with slight fall.

"In case the stream's course offers very little fall, what effect does this have upon the rapidity of the stream?" "Upon the course of the stream?" "How would obstructions affect the course?" etc.

With abrupt fall.

"In case the stream's course gives abrupt fall, what forms will be the result?" etc.

Let all be illustrated, especially with remote and generally known instances, since yesterday's lesson employed largely illustrations from the local environment. Have pupils make schematic drawings of the typical forms on the blackboard. "How does the character of the soil affect the course of the stream?" Lay emphasis on erosion. Have class work out summary of the above on board, copying same into notebooks.

Development

Disposition of products of stream erosion.

Raise the problem: "What do you suppose becomes of all this loose material carried away by the erosion?" Suggest solution by the further question: "How is water able to carry off such heavy material as broken rock, etc.?" "What then would cause it to give up and drop its load?" Recall the familiar instance in the formation of lagoons.

General principle of deposition of sediment.

Formulation of hypothesis: the deposition of sediment wherever the stream's course is checked.

Implications of hypothesis: such deposits might be looked for, *e. g.*, where rapids give place to level stretches, etc. Let students suggest such, tabulating them for the

Verification: reference to personal observation, maps, reference books, etc., for a verification of each type.

Application

Forms of deposition: lagoons, natural dikes, alluvial fans and cones, deltas, etc., estuaries. Selection of examples depending on environment, available equipment, etc. General levelling action of erosion.

"What form would the deposit take in each of the types tabulated?" By reference to pictures, relief maps, etc., have class trace out the typical forms of deposition, and describe essential features of each.

Assignment

Text-book treatment of above. Think out the economic significance of each of the phenomena studied. Individuals prepare reports on well-known instances, *e. g.*, the Mississippi Delta, the site of Interlaken, etc. Students bring to class any especially good pictures of erosion phenomena. These are to be used next day as partial material for an appreciation of the natural wonders of stream erosion.

ALGEBRA

Lesson developed yesterday: The concepts of factor and factoring; the separation of monomial factors from quantities of one or more terms; the factoring of such squares as $a^2 + 2ab + b^2$ and $x^2 - 2xy + y^2$.

Assignment for to-day: An exercise containing problems calling for the factoring of such expressions as $x^3 - x$, $3xy^3 - 6x$, $4x^2 - 4xy + y^2$, etc.

Lesson to be developed to-day: The factoring of polynomials which are perfect squares.

Aim of lesson: A better knowledge of the meaning of factoring, training in thinking out the relationships between factoring and multiplication, a knowledge of the method of factoring indicated, and efficiency in its use.

PROCEDURE

CONTENT	METHOD
Recitation	
Meaning of terms: factor, factoring.	"Is b a factor of $a + b$?" "Is $a + b$ a factor of $a + b + c$?" "Give an illustration of a factor." "What is the difference between that case and the ones I gave?" "What do you mean by a factor?" "Then wherein were my examples incorrect?" etc.
Assigned and supplementary problems (for test and drill).	Report on difficulties. Discussion of any experienced by several students. Part of class at board, part at seats, to work dictated problems. Assist students with difficulties still unexplained. Explanation by students of typical examples worked upon the board. Rapid oral drill on simpler problems.
Review and propædeutic. Squaring of polynomials by inspection.	Oral quiz, ending with squaring of $a + b + c$ on board.
Development	
Discovery of method for factoring squares of polynomials.	Raise the problem: "How shall we factor $x^2 + y^2 + z^2 + 2xy + 2xz + 2yz$? $l^2 + m^2 + n^2 + 2lm + 2ln + 2mn$? etc." Discovered to be similar to the square of $a + b + c$. Discussion leading to Hypothesis: that they are the squares of $x + y + z$, $l + m + n$, etc., and Implications: that similar expressions can be factored in like manner. Verification: have class square $x + y + z$ and similar trinomials, comparing results with expressions factored. Extend verification to such expressions as $x^2 + 4y^2 + 4 + 4xy + 4x + 8y$, to expressions in-

volving negative signs, to squares of quadrinomials, etc.

Formulation of general rule.

"In all these expressions we have been factoring, what common characteristics do you see?" Let this take the form of a summary, *e. g.*:

1. The squares give the terms of the factors.

2. There are as many terms as squares.

3. The cross products give the signs.

4. The cross products must be double cross products.

5. There must be a cross product for every possible combination of dissimilar terms.

Thence develop the rule: "A polynomial consisting of several positive squares and a corresponding number of double cross products of the terms represented by the squares may be factored into . . .," etc. General drill on statement of rule.

Application

Similar problems of greater difficulty.

Have one student work at board two or three examples of moderate difficulty, with class dictating the work and justifying each step. Have a typical example explained, making suggestions as to form of explanation. Follow with class at board working similar problems not taken from text-book.

Assignment

Series of typical problems in text-book, of greater complexity and difficulty than those discussed in class. Discuss with class any points which the students are not prepared to study out independently.

UNITED STATES HISTORY

Lesson developed yesterday: McKinley's election and administration up to the Spanish War.

Assignment for to-day: Text-book account of same and summary of accounts of Nashville Exposition and discovery of gold in the Klondike, in notebooks; supplementary readings from the platforms of the various political parties, and selected editorials from newspapers at time of the election. Two students to report jointly on Cuban history, 1866–1895.

Lesson to be developed to-day: The outbreak of the Spanish War.

Aim of lesson: Knowledge of the facts and significance of the Cuban War, formation and training of habit of impartially seeking causes and motives in political activities, and appreciation of the moral issues involved in the declaration of that war, and of war in general.

PROCEDURE

CONTENT	METHOD
	Recitation
Presidential nominations of 1896.	"We have seen that the year 1896 found the country politically divided, with different sections urging different demands upon political leaders. Tell us about this sectional division, with the demands of each section." "How do you account for the various demands?" "How was the membership of the parties affected by this sectionalism?" Question for the cleavage within parties, the fusion of factions of hitherto politically opposed groups, the nominations of the various parties, and the strategic motives in these nominations.
Campaign of 1896.	Call for the events and features of the campaign; bring out comparison with campaigns of 1916 and 1920 as to methods, and the effect of methods on final result.
Proposed Anglo-American General Arbitration Treaty.	Topical recitations, covering frequency of occasions for international disagreements, recognition of need

for better provision for arbitration, and attempted treaty and its general provisions; public sentiment in the United States and in England regarding the treaty; defeat of measure; effect of negotiations upon international friendship, in the United States, in England, and on the Continent. General sentiment toward international peace.

Implications for a League of Nations.

Summary of important features of the administration thus far.

Development

Situation in Cuba.

"Probably the most important event of McKinley's administration, perhaps of the last fifty years up to that time, was the war with Spain. We can understand its significance only by understanding how it came about." Raising an information problem, and developing with the class, in outline only, the form of the solution. The assignment, followed by next day's class exercise, is to complete the solution.

Recall with class the early history of Cuba, including the basis for Spain's ownership of Cuba and the fact that Spain had retained Cuba, while disposing of or losing Florida and other colonies. Call for report on history of Cuba, 1866–1895. Relate briefly the events of the Cuban revolt from 1895 to 1897. Study map of Cuba, leading pupils to observe the location of centres of population, the main lines of communication, and the consequent predominant type of warfare (guerilla). In-

dicate the location and field of operation of the Spanish and Cuban armies and lead class to see the significance of the Reconcentration Plan.

Maine incident.

Refer to the sinking of the *Maine*, and the subsequent investigation by the United States and by Spain. Compare with report of 1911 Board of Investigation. Let the students contribute the data for above so far as possible.

Declaration of war.

"What effect would you expect all these events to have upon popular feeling in the United States?" For the answer, direct attention to the economic strength of the United States; popular pride in the navy, increased by the naval review at Grant's funeral; popular desire for peace, manifested in Arbitration Treaty negotiations; Spanish oppression and American attitude toward any country seeking to become a republic.

Leave the verification of students' anticipatory judgment to the assignment.

Tell the class about the note to Spain, Spain's response, and the declaration of war.

Summary.

Develop with class a summary of the Cuban situation and outbreak of Spanish War, as already considered. Have summary entered in notebooks, as outline for to-morrow's study.

Application

"What ought to be our attitude toward war?" Especially in case the opposing nation is too weak to offer serious opposition. Compare with the dispute with Mexico, in

1845; in 1916. Compare with the entry of the United States into the great World War.

Lead class to see that the whole situation in 1896 was but a natural outcome of the general movement toward independence of the American peoples, with the United States as the strongest, the leader.

Discuss the dawning self-consciousness of the United States as a world-power under moral as well as political obligations for world betterment.

Assignment

Text-book study of the events discussed in the lesson development; note particularly for study the friendly official policy of the administration in the United States toward Spain before the war was threatened, and the interchange of warship visits; the de Lome incident; the preparation of Spain and of the United States for war, and the respective advantages of each due to geographical position. Assign a review of the geography of the West Indies and the coast of Florida. Assign reading of Captain Sigsbee's personal account of the sinking of the *Maine*, and of contemporary editorials dealing with the situation.

SPANISH

Designed for beginning class: freshmen in four year high school. Period, forty-five minutes. Direct method; so far as practicable, directions and explanations given in Spanish. Whenever possible, the meaning of the expression will be shown by the performance—by both teacher and class—of appropriate actions; by giving equivalent expressions which are already familiar to the class; in case of need, by translation or by clear explanation in English.

Lesson developed yesterday: Use of *estar* in the present indicative.

Assignment for to-day: Important uses of *ser*.

Lesson to be developed to-day: The fundamental distinctions in meaning and use between *ser* and *estar*.

Aim of lesson: Knowledge of the meaning and use of these verbs, "clinching" of the knowledge acquired, and power to use the verbs correctly in cases which should admit of no doubt.

PROCEDURE

CONTENT	METHOD
	Recitation
Review of previous assignment.	Estoy aquí. ¿Dónde estoy yo? Vds. están allí. ¿Dónde están Vds.? ¿Estamos en la calle? ¿Estamos en la iglesia? ¿Estamos en la escuela? El libro está sobre la mesa. ¿Está Vd. sentado? ¿Estoy yo sentado? Nosotros estamos sentados. Yo estoy en pie. Vds. están sentados. Ahora, yo estoy sentado. Ahora, Vds. están en pie. ¿Dónde está la clase? La clase está en la escuela. ¿Dónde está la escuela? La escuela está en la calle de Washington. ¿Dónde está la iglesia? La iglesia está cerca del Parque Central. ¿Dónde está nuestra ciudad? La ciudad está en los Estados Unidos. Yo estoy bueno. ¿Están Vds. buenos? Estamos malos. Estamos enfermos. ¿Está Vd. ocupado? Yo estoy ocupado. La puerta está abierta. Have class write the proper verb form in the following: Nosotros —— en la clase. Vds. —— sentados. El comerciante —— en el despacho. Nuestra casa —— en la calle de Santiago. Las ventanas —— cerradas.
	Development
Uses of *ser*.	Clase, yo soy una mujer, Juan es un muchacho, María es una muchacha. Yo soy la maestra, Vds. son los discípulos. ¿María, es Vd. la maestra? No, señora, yo soy una alumna. ¿Somos todos mejicanos

HOME ECONOMICS

Designed for first year class in junior high school

Lesson developed yesterday: The cooking of fruit.
Assignment for to-day: The cooking of some fruit at home, as an application of the method learned in school yesterday.
Lesson to be developed to-day: The cooking of breakfast cereal.
Aim of lesson: Knowledge of the properties of starch and the effect of heat upon it; knowledge of and efficiency in the processes of the cooking of breakfast cereal.

PROCEDURE

CONTENT	METHOD
Recitation	
The cooking of fruit, in the laboratory and in the home.	"What did we prepare yesterday which we sometimes like for breakfast?" "How did we cook the fruit?" "Have you cooked any fruit at home since we learned how yesterday?" Questioning to see that the home cooking of the fruit was an application of principles and processes learned yesterday.
Development	
The problem of the lesson.	"What did you have for breakfast this morning?" (Fruits; cereals, such as cream of wheat, etc.) "We know now how to cook the *fruit.* To-day, let's learn how to cook the cream of wheat, in case our family want that for breakfast."
Material conditions of problem.	Demonstration procedure, with explanations. Determine contents of package of cream of wheat, in cups and by weight; cost of package.
Process; demonstration.	Teacher proceeds to the cooking, calling attention to the proportion of salt and of cereal to one cup of water, and the adding of the cereal to the water. "How can you tell how long to cook the cereal over the flame?" (Till thick enough to eat.)

"Why, do you suppose, it is better to use a double boiler?"

1. Prevents burning.

2. Saves time, since stirring is unnecessary.

3. Can cook cereal a long time with less heat; should be ¾ hour, and longer if possible.

Process; performance by pupils.

Pupils cook the cream of wheat as teacher has demonstrated; using 3 tablespoons of cream of wheat in 1 cup of boiling water to which ¼ teaspoonful of salt is added.

Properties of starch; solubility and tests.

While cereal is cooking, take up the study of starch.

1. Experiments. (Demonstration procedure.)

a. Insolubility in cold water. Soak a little cream of wheat in cold water. Pour off water, and let stand until the starch settles out. "Did the starch dissolve in the cold water?"

b. Solubility in hot water. Heat some starchy water from cream of wheat. "Is starch soluble in hot water?" "What difference do you observe in its appearance?"

c. Detection with iodine. Put a few drops of dilute iodine in some starchy water. "What color does the starchy water become when the iodine is added?"

d. Iodine tests with other foods. Have pupils make the test with bread, rice, egg, sugar, and butter (in test-tubes).

2. Explain to class the cellulose wall of starch granule, and the need for great heat to break it; then the swelling of the starch grains, taking up much water, making the mixture thick. "Suppose that you wanted to

find out whether a food has starch in it. How would you do it?"

3. Have each pupil look at starch under a microscope, and try to draw a starch granule on the board.

Sources of starch.

4. "Do you know of any vegetables that have starch in them?" Call for a list of all the grains the pupils know. "Which of these do we eat whole?" (Rice.) "Which is cracked in big pieces?" (Cracked wheat, oats. Show some to class.) "Which are cracked very fine?" (Cream of wheat.) "Which are rolled out flat?" (Rolled oats.) "Which are powdered very fine?" (Corn-starch and flour.)

Manufactured forms of cereals; uncooked and cooked.

"What cereals do we eat without cooking them?" "Are these uncooked or ready cooked in manufacture?" Show some of these. "Remembering what we know about starch, why would uncooked cereals be useless as foods?"

Comparative study of various cereal foods.

5. Have a pupil measure and weigh a package of rolled oats. "If we allow (so much) for a serving, about how many servings do you think there would be in the package of rolled oats?" Place on the board the weight, measure, number of servings, and cost of package of rolled oats, and of cream of wheat. Ask pupils to determine what each costs for one serving. Follow the same method of study for corn flakes and cream of wheat.

Serving; principles involved.

6. Serving cereals. Teacher show the cereal she has cooked in demonstration to illustrate thickness (thick enough to hold in mouth a few moments). If possible, show several different kinds of cereal dishes and

spoons. "Why do we want to have cereal very hot when we serve it?" (Cools quickly when cold milk or cream is added.) "What different things have you seen people eat on cereal?" Teacher completes the list, which should include: cream, top milk or whole milk, sugar (powdered, brown, or granulated), fruits which may be served in or with cereal. Show the value of sugar with cereal. Unusual accompaniments: butter instead of cream, maple or other syrup. Dry prepared cereal (*e. g.*, corn flakes) on hot cooked cereal.

Serving; practical exercise.

Have class serve the cereal they have cooked. Teacher see that this is properly done (including etiquette if necessary).

Have laboratory put in order. (Directions in previous lessons should suffice.)

Application-Expression

Laboratory application.

Have each pupil prepare and serve a dish of cream of wheat.

Home application (assignment).

Ask each girl to prepare a cereal at home and report about it to-morrow.

Summary.

Have class summarize the principles introduced, under the following heads:

1. Detection of starch.
2. Effect of boiling water on it.
3. Sources of starch.
4. Kinds of cereals.
5. Steps in cooking cream of wheat.
6. Serving a cereal.
7. Use of double boiler. Advantages. Substitutes.

Ask pupils to tell some one at home about each point before next lesson.

Teacher's Preparation for the Lesson

A. Materials.
1. List of supplies for lesson.
2. List of dishes and utensils necessary.
3. List of materials for teacher's demonstration and experiments.
4. Board work necessary.
5. Microscope and slide for starch prepared.
6. Supplies for class work ordered.

B. Time schedule, carefully worked out.
1. Recitation procedure.
2. Teacher's demonstration.
3. Pupil's cooking of cereal and placing in double boiler.
4. Study of starch and cereals.
5. Serving cereals.
6. Putting laboratory in order.
7. Summary.

The foregoing lesson plans are all of the development type; not because all lessons should be of that type, but because development lessons are as a class most difficult to plan, and hence call especially for illustration. It is felt that lessons of the recitation type demand no further illustration than is given in the recitation and expression-application procedure of the lesson plans given above.

INDEX

Absoluteness, of measurement, 271; of standard, 264.
Abstract as related to concrete, 109, 131.
Acquired efficiency, transfer of, 21–25; basal principle in transference, 21; in information problems, 138; in thought problems, 167; pedagogical applications of the principle, 24.
Acquisition of information, 32, 132, 228.
Act of thought, composition of, 139.
Action type, differences in, 313.
Activity, as basis for learning, 10, 100, 130; distribution of, 50; importance in classroom, 48; in questioning, 64.
Adams, 37, 50.
Adequacy, of answer, 68; of expression, 70, 197.
Adolescence, 6.
Aims in Instruction (Chapter III), 28–42; educational aims, 28; aims of instruction, 29; essentials of instruction, 30; factors of method, 31; lesson aim, 35; modes of instruction, 39; lesson types, 39; formal steps, 40; summary, 41; aim of appreciation instruction, 174; of laboratory instruction, 209.
Algebra, lesson plan, 343; tests for, 277.
Analogy, 107.
Analysis, 19, 57, 139; in appreciation, 182.
Analytic question, 57.
Answer, the, in questioning, 68.
Anticipatory judgment, 141.
Appeal, of appreciation situation, 184; of problematic situation, 147.
Appendix, 341.
Apperception in teaching, 94, 106.
Application, in study, 195, 210, 235; application laboratory, 215; meaning of, 188; of measurement, 267; through quiz, 81; relation to home study, 194; relation to laboratory, 208; relation to verification, 157.
Appreciation, testing for, 268.
Appreciation factor, 35.
Appreciation laboratory, 214.
Appreciation Mode (Chapter IX), 173–187; character and function, 173; meaning of sentiment, 173; aim of appreciation instruction, 174; types and forms of appreciation, 176; appreciation in the high school curriculum, 176; procedure in appreciation mode, 177; appreciation by teacher, 178; realness of situation, 178; familiarity with medium of expression, 180; understanding of thought, 182; appeal of situation, 184; classroom atmosphere, 185; summary, 186.
Appreciation study, 233.
Appropriateness of instruction, 76.
Arithmetic, test for, 276.
Artisan teacher, 4.
Artist teacher, 4.
Assignment, relation to development, 125; relation to class work, 201; time of, 202; definiteness of, 203; motivation of, 204; amount

of, 204; in laboratory, 216; in lesson plan, 250.
Assistance by teacher and individual instruction, 319.
Association, associative learning, 17; after dissociation, 18; in memory, 89; in information problem, 138; in thought problem, 139; in study, 231.
Atmosphere of classroom, 47, 185.
Attention, importance of, 14; securing of, 15; active and secondary passive, 16; in dissociation, 20; in study, 241.
Attitude of study, 225.

Bagley, 137.
Baker, 183.
Ballou, 276.
Bigelow, 217.
Blackboard, 49, 201, 255.
"Born" teachers, 4.
Bourne, 176, 209.
Breslich, 195, 242.
Brevity of question, 61.

Carpenter, Baker, and Scott, 183.
Charters, 56.
Chubb, 137.
Clapp, 284.
Class conference, 44.
Class Exercise (Chapter IV), 43–54; meaning, 43; personality in class exercise, 45; atmosphere of class exercise, 47, 185; classroom activity, 48; summary, 53; social aspect of, 327.
Classification, 144.
Colvin, 180.
Comparison of achievements, 262, 296.
Comparison-contrast, 226; question, 58.
Composition of an act of thought, 139.
Concept, 24.
Concrete to abstract, 109, 131, 156, 192.
Conditions for study, 236.
Conditions of drill, 90, 231.
Conference, 44, 83, 244, 318.
Consciousness in method, 2.
Content of lesson, 248.
Contrast, 226; contrast question, 58.
Conversational method, 104.
Co-operation of students, 36, 329.
Correction through quiz, 80.
Courtis, 276, 277, 300.
Cramming, 93.

Deduction, 110, 131, 141, 144, 164; deductive method, 110, 141, 164; deductive problem, 131, 142, 143, 164.
Definiteness, of assignment, 203; of hypothesis, 153; of problem, 143; of standard, 264.
De Garmo, 13, 49, 56, 122, 130, 144, 148, 212.
Description, in English composition, 276; in laboratory, 213.
Development. See Lesson development.
Development question, 57.
Dewey, 1, 33, 41, 44, 50, 110, 130, 135, 139.
Diagnostic grading, 302.
Differences, individual, 11; environmental, 310; hereditary, 311; intellectual, 311; of temperament, 313; of action, 313.
Differentiation, 338.
Directing of interest, 13.
Discovery, 121, 137.
Discussion in quiz, 81.
Disjunction, 18.
Dissociation, 18, 138.
Distribution, of activity, 50; of grades, 288, 301; of questions, 64.
Drill, 34; recitation as drill, 83; function of, 83; applicability of, 83, 231; upon processes, 85; upon facts, 87; conditions of, 90; application of, 92; in study, 230, 231.

Effect, law of, 85.
Efficiency, as aim in instruction, 293, 325; in teaching, 2, 259; testing for, 269; question as index of efficiency, 67.
Emotion, 173.
Empathy, 174.
Enforcement of lesson preparation, 79.
English composition, test for, 273.
English lesson plan, 352.
Environmental differences, 310.
Equipment of child, 10.
Evaluation of methods of instruction, 297.
Examination, 82, 259.
Excursion, 213.
Exercise, law of, 86.
Exercises, 193.
Experience as source of information, 134, 228.
Experimental laboratory, 211.
Explanation, 160.
Expression-Application Mode (Chapter X), 188–206; character and function, 188; forms of expression and application, 190; home study as application, 194; essentials of expression and application, 196; lesson assignment, 201; summary, 205; expression in study, 236; expression in testing, 295; familiarity with medium of expression, 180.

Factors of method, 31.
Facts, drill upon, 87, 231.
Familiarity, of illustration, 113; of medium of expression, 180.
Fatigue, in drill, 91; in study, 241.
Feeling, 29, 30, 33, 101, 173, 189, 313.
Field excursion, 213.
Finding-out problem, 131, 228.
Fixation in drill, 86.
Formal discipline, 21. See Transfer of acquired efficiency.
Formal steps, 40.
Forms of application, 192.
Forms of expression, 191.
Formulation of problem, 143.
French, test for, 283.
Frequency, distribution of, 288.
Function of teacher, in laboratory, 217; in thought problem, 162.
Fundamental Principles of Learning (Chapter II), 10–27; the child's equipment, 10; interest and teaching, 11; attention and teaching, 14; associative learning, 17; transfer of acquired efficiency, 21; summary, 25.

Generalization, 24, 81.
Genuineness of expression, 197.
Geometry, tests for, 285.
German, tests for, 283.
Grading of pupils' work, 287, 301.

Habit, social, 29, 326.
Habit-forming, 85, 230.
Handwriting, test for, 272.
Harvard-Newton test, 276.
Hereditary differences, 11, 311.
Heuristic method, 121.
Hillegas, 273, 275.
History lesson plan, 346.
Home economics lesson plan, 355.
Home study, as application, 193, 199; justification of, 195, 222; relation to class exercise, 195; relation to laboratory, 207.
Hotz, 279.
Hypothesis, 152, 162, 232.

Illustration, 111; relation to analogy, 116; requirements of, 113.
Imagery, 179.
Immediacy of expression and application, 197.
Impression in memory, 88.
Inclusiveness of standard, 265.
Individual and Social Elements in Secondary Instruction (Chapter XV), 309–340; individual instruction, 309; social instruction, 319;

relation between individual and social instruction, 336; summary, 338.
Individual differences, 11, 45, 309.
Individual instruction, meaning, 309; environmental differences, 310; hereditary differences, 311; teacher's attitude toward individual differences, 315; specific forms of individualizing instruction, 316.
Individual needs of pupils, 262, 299, 309.
Inducing of interest, 12.
Induction, 110, 131, 141, 144, 164; inductive method, 164; inductive problem, 131.
Inference, 214.
Information problem, 131.
Information-getting in study, 228.
Initiation in drill, 85.
Instincts, 10.
Instruction, adequacy of, 75; aims of, 29; essentials of, 30.
Integration, 338.
Intellectual differences, 311.
Intelligence of drill, 91.
Interest, directing of, 13; inducing of, 12; interest and teaching, 11.
Investigation by student, 137.

James, 19, 85, 87.
Johnston, 5.
Journal of Educational Psychology, 297.
Judd, 22, 181, 242.
Judgment in appreciation, 173, 234.
Judgment question, 58.

Kansas silent reading test, 286.
Kelly, 286.
Knowledge, 29; social, 321; testing for, 267.
Known to unknown, 106.

Laboratory in lesson plan, 252.
Laboratory instruction, 317; as application, 192, 215.
Laboratory Mode (Chapter XI), 207–221; relation to home study, 207; to development, 207; to application, 208; aims, 209; experimental, 211; observational, 212; appreciation, 214; application, 215; problem assignment, 216; function of teacher, 217; results, 219; summary, 220; socialization of laboratory, 334.
Ladies' Home Journal, 194.
Latin, test for, 283.
Law of effect, 85.
Law of exercise, 86.
Leadership of teacher, 329.
Learning, 88, 102.
Lecture method, 122.
Lesson aim, character of aim, 36; student's aim, 36; teacher's aim, 35; in lesson plan, 248; in study, 226.
Lesson assignment, 201, 240, 250.
Lesson content, 248.
Lesson Development (Chapter VII), 100–128; learning and feeling, 100; meeting of situations, 100; development in teaching, 102; known to unknown, 106; analogy, 107; simple to complex, 109; concrete to abstract, 109; illustration, 111; student contribution in development, 116; Socratic method, 118; heuristic method, 121; lecture method, 122; place of development in class exercise, 123; relation to recitation, 123; relation to assignment, 125; relation to laboratory, 209; in lesson plan, 248; summary, 126.
Lesson Organization (Chapter XIII), 247–258; significance of organization, 247; the lesson plan, 248; summaries in the lesson, 254; review and the review lesson, 255; summary, 257.
Lesson outline in study, 227.
Lesson plan, 248. See Lesson organization.

Lesson plans, illustrative, 341.
Lesson preparation, 76.
Lesson types, 39.
Library, 213, 219.
Lloyd and Bigelow, 164, 176, 211.

MacVannel, 4.
Mahy, 182.
Mathematical report cards, 80.
Matured answer, 68.
Measurableness, 265.
Measurement, 259; applications of, 267; essentials in, 263; kinds of, 271; teacher's use of, 292.
Medium of expression in appreciation, 180.
Meeting of situations, 100.
Memory, 83, 87; memory-forming (memorizing), 87, 229; memory question, 56.
Mental conditions for study, 239.
Method, 1, 6.
Minnich, 244.
Modes of instruction, 39.
Monroe, 277.
Mood, 47, 185.
Moore, 151.
Motivation, in assignment, 204; in drill, 230; in problem, 146; in study, 240.
Münch, 5, 53.

Note-taking, 136.

Objectivity of standard, 264.
Observation, 134, 137, 168, 210, 213, 228.
Observational laboratory, 213.
Oral quiz, 80.
Organization, significance of, 247.
Organization and unity in lesson plan, 247, 253.
Organization in study, 226.
Orientation in study, 226.
O'Shea, 325.
Outline of lesson in study, 227.
Over-instruction, 117.

Parker, 91, 104, 242, 332.
Percentage grading, 289.
Permanency, as an aim in teaching, 31, 83; testing for, 269.
Personality, 45.
Pettiness in appreciation instruction, 185.
Physical conditions for study, 237.
Physical geography lesson plan, 341.
Physics, test for, 282.
Pillsbury, 87.
Pivotal question, 250.
Plan of lesson, 248. See Lesson organization.
Plato, 120.
Practicability of standard, 265.
Preparation of lesson, 75, 76.
Preparedness of teacher, 52.
Principles of method, 5.
Problem, 129.
Problem assignment in laboratory, 216.
Problematic Mode (Chapter VIII), 129–172; character and function of problem, 129; sources of information, 132; composition of an act of thought, 139; procedure in thought type of problematic mode, 142; application of problematic mode, 163; summary, 170.
Problems in study, 228.
Processes, drill upon, 85, 230.
Project method, 149.
Proof, 161.
Propædeutic function of recitation, 94, 251.

Quest (Hall-Quest), 244.
Question (Chapter V), 55–73; function, 55; kinds, 56; essentials of good questioning, 59; manner of questioning, 63; number of questions, 67; the answer, 68; pupil's question, 71; summary, 72; in lesson plan, 249.
Quiz, 80.

Reading, as source of information, 133; test for, 286.
Realness, of appreciation situation, 178; of problem, 146.
Reasoning, 19.
Reasoning implications of hypothesis, 154, 232.
Reavis, 238.
Recall, 88.
Recitation in lesson plan, 251.
Recitation Mode (Chapter VI), 74–99; meaning of recitation, 43, 74; recitation as testing, 75; recitation as drill, 83; propædeutic function of recitation (apperception), 94, 251; summary, 98.
Recognition, 88, 89.
Recognition of problem, 143.
Reflection, 32.
Rein, 36, 41, 95.
Relative measurements, 271.
Repetition in drill, 86, 90.
Response to situation, 101, 129, 173.
Results, use made of, in laboratory, 219.
Retention, 87.
Review, 94, 255.
Review lesson, 256.
Rogers test, 281, 286.
Rugg and Clark, 281.

Sackett, 286.
School museum, 213.
School work, forms of, 43.
Scientific method, 168.
Securing and controlling associations, 17, 231.
Securing of attention, 15.
Self-control, 207, 222.
Self-direction, 222.
Self-teaching, 223.
Sensitivity to problems, 169.
Sentiment, 30, 173.
Simple association, 17, 85.
Simple to complex, 109, 199.
Situation and response (meeting of situation), 100, 129, 173.
Skew in graph of grade distribution, 290, 304.
Skill, 2, 210.
Smith and Hall, 160, 176.
Sneddon, 150.
Social aims (social intelligence, disposition, efficiency, habit), 29. See also under Social instruction.
Social clearing-house, 44.
Social instruction, 319; social intelligence, 321; social disposition, 323; social efficiency, 325; social habit, 326; school agencies for social instruction, 327; forms of socialization of instruction, 330.
Socialized recitation, 332.
Socratic method, 118.
Soundness of hypothesis, 153, 155, 232.
Source method in history, 209.
Sources, use of, in laboratory, 218.
Sources of information, 132, 228.
Spanish lesson plan, 349.
Spirit of work, 48.
Standards and Measurements in Instruction (Chapter XIV), 259–308; need and value, 259; essentials in measurement, 263; measurableness, 265; applications of measurement, 267; typical standards and forms of measurement, 271; practical value of standardization and measurement, 292; summary, 306.
Starch, 22, 78, 282, 283, 304.
Statement of verification, 159.
Steps in thinking, 139.
Stevens, 56, 67.
Stockard and Bell, 285.
Strayer, 71.
Stromquist, 278.
Student activity, 10, 48, 64, 67.
Student contribution of illustration, 116.
Student responsibility, 329.
Student's aim in lesson, 36.
Study, teaching to, 223; self-teaching, 223; study attitude, 225;

orientation and organization, 226; information-getting, 228; memorizing, 229; thinking-out of problem, 232; appreciation, 233; application in study, 235; expression, 236; conditions for study, 236.
Study as Self-Teaching (Chapter XII), 222–246; student self-control and self-direction, 222; justification of home study, 222; teaching to study, 223; supervised study, 241; summary, 244.
Study attitude, 225.
Study hour, 318; socialization of, 335.
Study programme, 238.
Summaries in the lesson, 254.
Supervised study, 241.
Synthesis, 19, 139.

Teacher's aim in lesson, 35.
Teacher's appreciation, 178.
Teacher's function in hypothesis, 154.
Teacher's function in thought problem, 162.
Teaching to study, 223.
Telling, 132, 135.
Temperament, differences in, 313.
Tempo, 53, 185.
Tentative solution of problem, 151.
Testing, 34, 75, 259; ultimate function of, 299.
Text-books, 133, 136.
Thinking, steps in, 139.
Thorndike, 17, 22, 85, 94, 264, 269, 273, 275, 311, 316.
Thought problem, 131, 142; in study, 232; procedure in, 142.
Thought-power, 30; testing for, 268.
Thought-provoking question, 60; thought-provoking in laboratory, 217.
Thought-type, differences in, 312.
Time, use of, in study, 238.
Time of assignment, 202.
Titchener, 87, 173.
Topical recitation, 69.
Training, transfer of. See Transfer of acquired efficiency.
Traits, native and acquired, 10.
Transfer of acquired efficiency, 21, 138, 167; pedagogical application of, 24.
Translation, 193.
Twiss, 44.
Types of appreciation, 176; of hypothesis, 152; of lesson, 39; of problem, 131.

Understanding of thought in appreciation mode, 182.
United States History lesson plan, 346.
Unity in lesson plan, 253.
Universality of application, 200.

Validity of verification, 157.
Variety in procedure, 50.
Verification, of hypothesis, 156, 163; in laboratory, 210; relation to application, 157; relation to proof, 161.

Waste in laboratory, prevention of, 218.
Weglein, 304.
Welton, 217.
Will type, differences in, 313.
Woodhull, 150, 151.

Young, 80, 165, 176.

LIBRARY OF CONGRESS
0 021 774 643 7